MICROSCOPES
MAGNIFIERS
MICROTOMES
COLORIMETERS
PROJECTION
APPARATUS ETC

E. LEITZ
INC.
NEW YORK

CATALOG V-A

E. LEITZ, Inc.
NEW YORK

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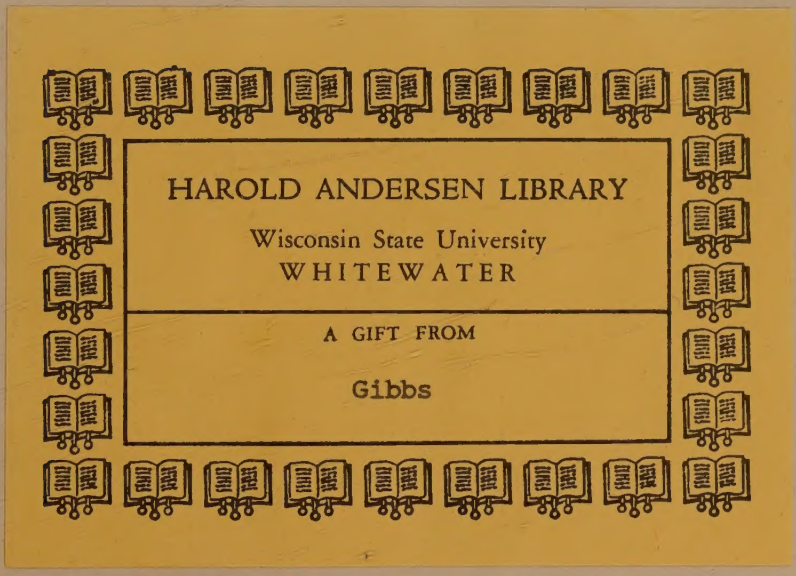

LEITZ

MICROSCOPES:

BIOLOGICAL (binocular and monocular)
POLARISING (petrographical)
METALLOGRAPHIC
UNIVERSAL
BINOCULAR of
WIDE FIELD TYPE
SPECIAL
MODELS

MAGNIFIERS
MICROTOMES
COLORIMETERS
PROJECTION
APPARATUS
ACCESSORIES
ETC.

E. LEITZ, Inc.
60 East 10th St.
NEW YORK, N. Y.

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1929

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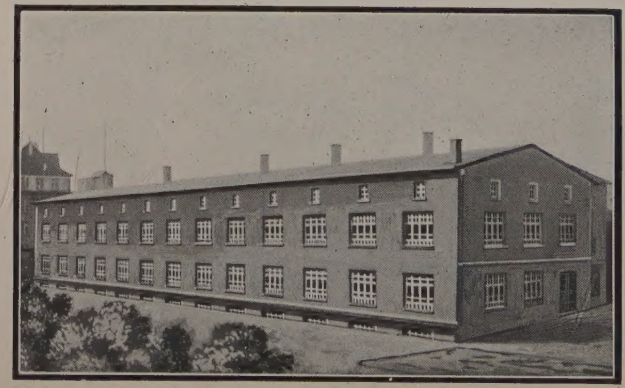

Branch Works—Rastatt (Germany)

Exposition Internationale de Fonderie
PARIS, 1-21 Septembre 1927
DIPLÔME
DE
GRAND PRIX
décerné à Monsieur E. Leitz (Fabricant d'Optique)
à Wetzlar (Allemagne)
GROUPE III
CLASSE 14
Le Président du Comité
d'Organisation et d'Admission
Président du Jury Supérieur,
ARTS
SCIENCES
PAX
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EXPOSITION INTERNATIONALE
DE FONDERIE - SEPTEMBRE 1927

NOTICES AND TERMS

Orders—To obviate errors, orders should be placed by giving catalog numbers, name of article and size, etc. In telegraphic orders, code words should be used.

Quotation—Our prices are f. o. b. New York, if not stated otherwise in our estimate. When sending goods on memorandum or for inspection, the transportation charges, both ways, are at the expense of the customer.

Credit—We suggest that purchasers, who have no account with our firm, or mercantile rating, have their first order accompanied by commercial references or remittance in cash, money order or check upon New York, since local checks may be subject to collection charges.

The Western Union Telegraph Co. accepts messages with remittance between points in the United States, therefore order and remittance can be sent in the same message.

C. O. D. Shipments—Orders on such a basis can be executed only if funds accompany order to cover delivery charges both ways. Orders for goods to be made especially cannot be accepted on a C. O. D. basis.

Shipment—Without receiving definite instructions, we will use our best judgment in mode of shipment. After delivery has been made to carrier, our responsibility ceases. Utmost care is exercised in packing and all goods are double checked. We obtain proper receipts from the transportation companies and all claims for breakage will have to be reported to the carriers, since we do not hold ourselves responsible for breakage and shortage of goods in transit.

Return of Goods—Goods to be returned, or sent for repair, should be plainly marked with the sender's name and address. Please give date of invoice on which the goods have originally been billed, wherever possible.

Prices—Prices listed are subject to change without notice.

E. LEITZ, Inc.
60 East 10th Street

New York, N. Y., March, 1929.

"LEITZ" STANDARD

of

OPTICAL and MECHANICAL PRECISION WORKMANSHIP

"Leitz" Microscopes are universally recognized for their **dependable and rigid construction** and their **superior optical and mechanical features.** The unfailing qualities of precision workmanship prompt foremost institutions of this and other countries

to adopt

"LEITZ" MICROSCOPES

AS STANDARD FOR RESEARCH WORK AND FOR MOST EXACT REQUIREMENTS AS WELL AS FOR DAILY CLASS ROOM USE.

The guaranteed optical and mechanical efficiency is the result of the untiring efforts on the part of the "Leitz" Research Staff to further new developments, and the "Leitz" Works, therefore, are recognized as leaders in the microscope field and as originators of new scientific instruments, which, on frequent occasions have caused a revolution in the construction and types of microscopical apparatus.

INDISPUTABLE FACTS EXPLAIN THE "LEITZ" SUPREMACY:

1. The manufacture of "Leitz" microscopes dates back to 1849.

2. **Ever since** the scientific world recognized the eminent importance of the microscope for its profession due to the discoveries of typhoid, tubercular, cholera and diphtheria bacilli by Professor Robert Koch and his co-workers, **the "Leitz" Works have led in the construction of modern microscope models and developed microscope optics** to an extent which led to their adoption by other manufacturers. These constructional improvements, originating with the "Leitz" Works, **are still the standard by which the microscope industry is judged and guided.**

3. With the continuous progress of microscopical science, the "Leitz" Works added definite types of research microscopes and microscope optics. **"Leitz" offers the greatest variety in microscopical equipment for research, routine school use and industrial purposes.**

4. **The "Leitz" Works by far outnumber all other microscope manufacturers in the production of microscope stands and microscope optics.**

To those who have not had occasion to convince themselves of the superior qualities of "Leitz" products, we shall gladly afford an opportunity to compare our instruments with those of other manufacture so that the superior quality prevalent in "Leitz" equipment can readily be established.

The purchase of "Leitz" Apparatus by Educational Institutions represents a saving in initial expense as well as a saving in cost of "upkeep" since our instruments **are guaranteed to give continuous and thorough satisfaction.** ("Leitz" apparatus are no higher in price than those of competitive make.)

The "Certificate of Guarantee" which accompanies each "Leitz" instrument, is sufficient proof as to the far-reaching protection offered to purchasers of "Leitz" equipment.

In our Repair and Adjusting Departments, we attend to the repair and reconditioning of Microscopes, Objectives, etc., and other scientific instruments. The personnel of these departments are highly skilled mechanics thoroughly trained in the manufacture of scientific apparatus.

MICROSCOPES and ACCESSORIES

In this new and complete catalog, we list numerous new models of microscopes which undoubtedly will create a far-reaching interest amongst those scientists who have to do with microscopic work. This is the first volume of our General Catalog in which we likewise cover microscopes and affiliated instruments which apply to fields where hitherto the microscope has found but little application, while with the standard of work that is now required in those fields, the microscope is gradually to occupy a place of utmost importance.

So that the reader may have available a ready guide, we summarize below under page reference, the listed **items of novel and improved design.**

Combination Research Microscope "IURM," for binocular and monocular vision (*listed on pages 39-41*)

Combination Research Microscope "ABMT," for binocular and monocular vision, with new built-in mechanical stage (*listed on pages 44-45*)

Combination Microscope "CBMT," for binocular and monocular vision, with new built-in mechanical stage (*listed on pages 50-51*)

Combination Microscope "LBMT," for binocular and monocular vision, with new built-in mechanical stage (*listed on pages 56-57*)

Monocular Research Microscope "AT," with new built-in mechanical stage (*listed on pages 62-63*)

Routine Laboratory Microscope "LT," with new built-in mechanical stage (*listed on pages 72-73*)

Capillary (Skin) Microscopes, Models "SC" and "LC" (*listed on pages 91-93*)

Slit-Ultra Microscope "SUM" (*listed on pages 95-97*)

Chemical Microscope "CHEM" — Universal Model (*listed on pages 98-100*)

Polarizing Microscope "MOP," for opaque ores (*listed on pages 117-119*)

Universal Microscope "UNMIC," for binocular and monocular vision (*listed on pages 127-129*)

Biological-Polarizing Microscope "CBMP," for binocular and monocular vision (*listed on pages 130-131*)

Camera, for binocular stereo microscopes (*listed on page 145*)

Binocular Corneal Microscope "CLM," (*listed on page 155*)

Arclamps, New Model (*listed on pages 159-160*)

Low-Voltage Lamp, for darkfield-, photo-micrographic- and monochromatic-light as well as spectral analysis (*listed on page 162*)

Monochromator (*listed on page 168*)

Combination Built-In Mechanical Stage No. 22613 (*listed on page 171*)

Electric Heating Stage after Walton, regulating automatically (*listed on page 180*)

Binocular Head Magnifier (*listed on pages 186-187*)

Micro Manipulator, devised by Dr. Robert W. Chambers (*listed on pages 194-199*)

Rollfilm Micro-Attachment-Camera, using standard cinema film (*listed on pages 202-203*)

Simplified Micro Drawing and Projection Apparatus "SPD," for student laboratories, after Dr. Thuringer (*listed on pages 251-252*)

"Two-Lamp" Projector "XII," for opaque objects, lantern slides, etc. (*listed on pages 262-264*)

"Four-Lamp" Projector "IIIf," for opaque objects and lantern slides (*listed on pages 265-267*)

Projector "MPS," for the projection of mineral slides in polarized light (*listed on pages 269-273*)

Projector "EDP," for the projection, demonstration and photo-micrography of optical phenomena and mineral slides in polarized light (*listed on pages 274-278*)

"Leica" Camera, Rollfilm Type, with focal plane shutter, using standard cinema film (*listed on pages 280-282*)

Binocular Field Glasses, New Models, of various magnifications (*listed on page 283*)

Range Finders (*listed on pages 284-285*)

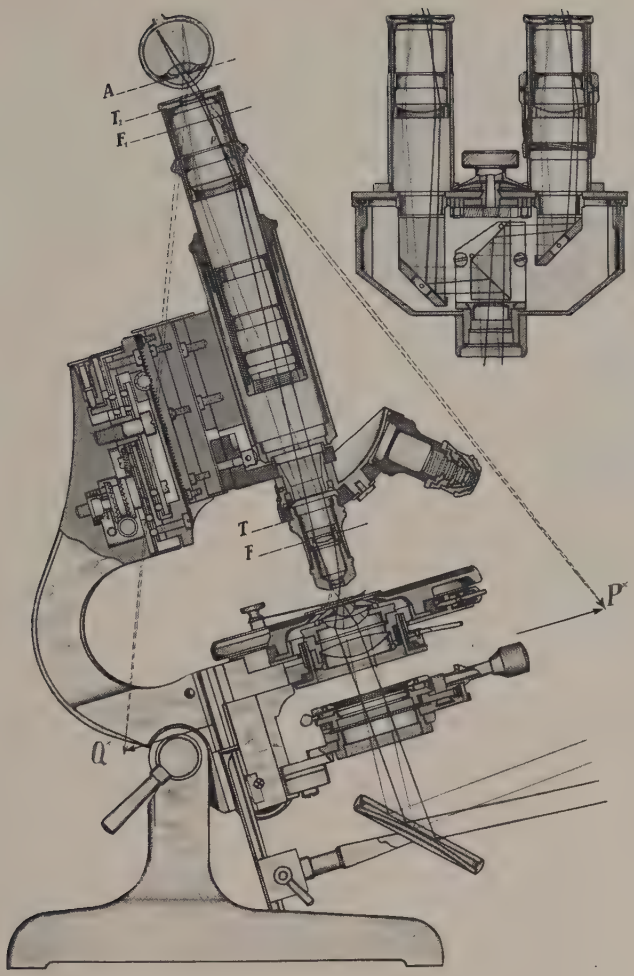


Diagram Showing the Paths of Light Through a Monocular and Binocular Microscope

This illustration represents, on a reduced scale, a colored wall diagram 43 x 27½ in., which together with a descriptive booklet is offered by us free of charge for use by lecturers and teachers. The diagram demonstrates a sectional view of the microscope "CCBM" (page 49) and shows the paths of the rays through the optical system of the instrument.

We draw special attention to a very instructive booklet entitled

"THE MICROSCOPE

Its Mechanical and
Optical Construction

Directions for Its Use and Care"

This literature offers an analysis of the mechanical and optical parts of the microscope and suggestions in respect to its proper care. We offer this booklet, likewise, free of charge.

General Survey of the Leitz Microscope Types

This catalog lists the general assortment of microscope types manufactured by the Leitz Works. Certain special models which, due to their peculiar construction and far-reaching means of application, afford an extensive description, are listed in this catalog briefly only and reference is made to the particular literature in which they are appropriately described. Other types again, the construction of which is such that the instruments are of but little use to the general microscopist, are not listed in this volume; however, reference is found to the individual sections of literature dealing with these apparatus.

Laboratories in which the microscope covers a universal range of application should give serious thought to the Leitz **Universal Microscope "UNMIC"** (pages 127-129). With this instrument, biological investigations may be carried out both under monocular as well as binocular vision and the tubes used for this purpose can readily be replaced by a tube of a polarizing microscope. At the same time, the standard biological substage can be replaced for the special substage of a polarizing microscope. Irrespective as to which microscope tube or substage is used, the optical axis remains permanently aligned and the objectives are retained in their changing devices, the latter being mounted independently of the tubes. This patented design brings with it the eminent advantage that for all the different investigation methods solely one microscope stand is required and in general only one set of objectives as well as oculars. Furthermore, the preparation may remain untouched upon the object stage while the interchange of tubes or substages takes place so that consequently, it is not at all necessary to transfer the preparation from one microscope to another, which eliminates the relocation of the spot of interest and the refocus of the specimen.

The ever-increasing interest in examining biological specimens likewise in polarized light makes it desirable to have available a microscope that affords quick conversion from one method to another and for this reason, the Leitz Works have constructed their **Microscope Model "CBMP"** (pages 130-131). This instrument, furthermore, permits interchangeable use of monocular and binocular tubes for monocular and binocular vision. The monocular tube serves for investigation under regular as well as polarized light and for this purpose is equipped with an anastigmatic tube analyzer mounted to slider for ready shifting into or from optical axis. For binocular vision, the binocular tube can either be used in place of the monocular tube or by means of a screw adapter with correction lens utilized as binocular attachment to the polarizing monocular tube. The stage is of the conventional type used in petrographical microscopes. The substage is of standard construction; however, it is supplied with polarizer which being mounted to a hinge can be easily swung in or out of place dependent upon when investigation in polarized light is to be carried out.

On pages 101 to 116, the standard line of **Petrographical** (Polarizing) **Microscopes** is listed and since the application of these instruments is generally known, we shall not dwell upon them in detail, this likewise for the reason that they are individually described on the pages referred to. The **Chemical Microscope "CHEM"** (pages 98-100), permits use in a universal manner; viz., for biological work, examination under polarized as well as reflected light, etc., such as is frequently encountered in chemical laboratories. On pages 120 to 125, different models of **Metallographic Microscopes** are listed.

The balance of microscopes this catalog covers are primarily offered for use in transmitted (non-polarized) light. In consequence, they are chiefly destined to serve for normal biological investigations; through the use of appropriate accessories (opaque illuminator and polarizing apparatus), they can likewise be made to serve for work in reflected as well as polarized light.

The large **Microscopes of the "A" Series** represent combination models, permitting interchangeable use of monocular and binocular tubes and consequently are available for monocular as well as binocular vision. These microscopes are provided with a wide monocular tube (50mm diameter) for photo-micrography which accommodates objectives of wide angle for use without ocular. The microscopes of the "A" series are chiefly selected for photo-micrography and research investigations.

The **Microscopes of the "CB" Series** are somewhat similar in construction to those of the "A" series, and are likewise, in the same manner as these, of combination type for interchangeable use of monocular and binocular bodies. The monocular tube is of standard diameter. The microscopes of the "CB" series are very popular for advanced laboratory use.

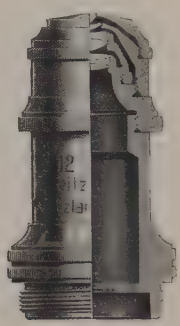
Under the **"L" Series** (pages 54-59 and 70-77) are offered those microscopes in wide use for routine investigations and in student laboratories. Aside from the microscope **"LBM,"** the balance of the "L" series is offered for monocular vision only. The "LBM" microscope likewise represents one of convertible pattern permitting it to be used for monocular as well as binocular vision.

MICROSCOPE OPTICS

A: General—The glass employed in the manufacture of Leitz objectives and oculars is selected exclusively from a grade which, long experience has proven, is not affected by atmospheric influences. We therefore are able to guarantee the lenses safe against spontaneous changes.

Regardless of the high standard of optical qualities of the Leitz objectives, the Research Departments of the Leitz Works are continuously carrying forward their efforts to increase the efficiency, wherever optical science permits of a further improvement. **The present series of Leitz objectives represents the crowning results of such efforts and it is without hesitancy that we make the statement that the Leitz objectives are the very best yet offered.**

As a guarantee of an unvarying quality it may be well to mention that each objective will have to pass the rigid test of the testing laboratories where these tests are conducted on a thorough, scientific basis. The optical data referred to in the tables on pages 14-19 represents the actual facts as to focal lengths, apertures, magnifications, etc.



The above illustrations demonstrate three different types of **Leitz Achromatic Objective.**

The first figure shows objective **No. 22008** (16mm—10X) representing one of the lower power dry lenses. It consists of two separate members, each of which again of two or three cemented lenses.

The second figure shows a high power dry objective **No. 22016** (4mm—45X) consisting of a hemispherical front lens and two members, each of which again of two or three cemented lenses. The hemispherical front lens is the magnifying element proper, while the spherical and chromatical corrections are attributed to the two other members.

In the third type, that of the oil immersion objective **No. 22022** (1.8mm—100X), the hemispherical front lens is succeeded by a meniscus lens while the third and fourth members are composed of two or three lenses and serve to effect the requisite optical corrections.

B: Magnification—As will have been noticed in our catalogs of previous edition, we carried under the tables for magnification, the column "initial magnification." The values in this column indicate the magnification of the objective proper. Under "magnification," one understands the ratio of the size of the real image formed by the objective on the upper end of the tube to the size of the object itself. This ratio, however, as mathematical considerations show, is equal to the ratio of the distance of this image from the focal point of the objective to the focal length of the objective itself. This distance is known as the **"optical tube length."** To explain further: The value "initial magnification" of the objective as given in our literature is therefore, optical tube length of objective divided by focal length of objective.

Note: The optical tube length is not the same for every objective, since it is an optical factor which changes for every objective type. The optical tube length should not be mistaken for the so-called "mechanical tube length." The latter indicates the distance between the thread shoulder of the tube against which the objective rests and the upper edge of the microscope tube. The mechanical tube length for all Leitz Microscopes for observation in transmitted light is 170mm.

The initial magnification of the ocular is determined in a way similar to that of the objective. The eye lens of the ocular acts as a magnifier, therefore its magnification equals 250mm (normal distance of vision), divided by the focal length of the ocular.

The objectives are engraved with the initial magnification, obtained according to the above formula, and these values are known as "magnification numbers." The oculars are likewise designated according to their magnifying power, derived from the above formula, and these figures are engraved upon the ocular mounting. It will be expected, therefore, that with these numbers engraved upon objectives and oculars respectively, the total magnification under which the object is seen can be obtained by multiplying the magnification number of the ocular by the one of the objective, provided however, that the mechanical tube length of 170mm as mentioned above, be maintained.

C: Tube Length—All Leitz objectives are corrected for a **mechanical tube length of 170mm.** This tube length should be adhered to particularly when high power objectives are being used. It has to be borne in mind that deviating coarsely from the correct tube length will impair the quality of objectives of high power.

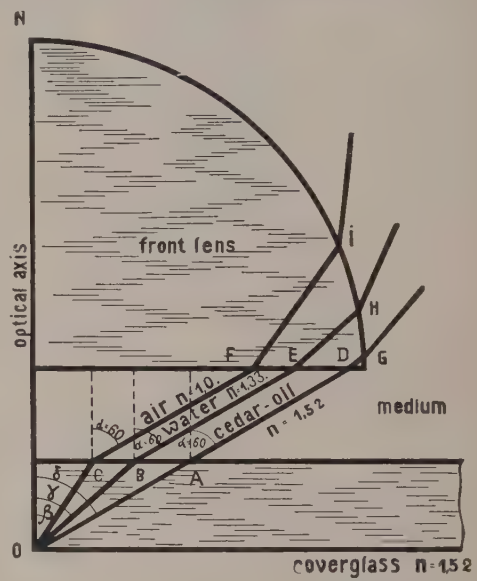
D: Coverglass Thickness—Objectives of medium and high power (from 6mm-30X upward) **are adjusted for a coverglass thickness of 0.16 to 0.18mm.** These measurements correspond to the coverglass thickness known as No. 1. It is advisable to especially select coverglasses of proper thickness for critical work or in case of high power objectives, to make use of those supplied with a coverglass correction collar. This is a very important feature, since a variation of 0.03mm in coverglass thickness will impair the spherical correction and in consequence the definition of the object.

A slight variation of the thickness of the coverglass can be compensated for by varying the tube length. For thinner coverglasses the tube length is to be increased while for thicker coverglasses it is to be shortened. The range of such a compensation varies with the equivalent focus and the numerical aperture of the objectives.

Immersion objectives are quite immune against variations in coverglass thickness since in case of oil immersions, the cedar oil used as immersion liquid, in its refractive index is practically the same as that of the coverglass. We recommend, however, to only use the immersion oil especially prepared by us.

For preparations without coverglass, i.e., metal specimens, etc., we furnish special objectives corrected for use with such objects.

E: Numerical Aperture—The efficiency of a microscope which is measured by its **resolving power,** increases with the magnitude of the angle of the pencil of rays which the objective is capable of receiving and transmitting to the eye. The measure of the aperture is not the angle itself but rather the quantity n.sin α, the so-called **Numerical Aperture** of the objective. In this expression n denotes the refractive index of the medium intervening between the coverglass and the front lens and α the angle comprised between the extreme rays of the pencil and the optical axis. The resolving power is directly proportional to the numerical aperture, and the light transmitting capacity, or the intensity of the image, to the square of the latter. The higher numerical aperture of immersion objectives at once accounts for the greater resolving power of these objectives as compared with objectives of the dry series. The accompanying diagram will serve to furnish a graphic demonstration of the effect of different intervening media.



The diagram shows the course of rays between the object and the front lens in the cases of three objectives of high power, one being a dry lens, another a water immersion objective and the third, an oil immersion objective, all of approximately similar focal lengths. While the coverglass has an invariable refractive index of 1.52, that of the media between the coverglass and the front lens varies from case to case. In the diagram, these rays are made to represent extremes which proceed in parallel directions; for instance, they are equally inclined in all three cases while traversing the respective media between the coverglass and front lens. The angle of inclination which has been chosen is 60°, which may be regarded as fairly representative of objectives with a large aperture. It then follows from the law of refraction, that the angle of inclination of the respective rays cannot be the same within the coverglass. In the homogeneous oil immersion system of objectives, every ray passes without being refracted from the object to the front lens, since cedarwood oil has the same refractive index as the coverglass. In the case of the water immersion, on the other hand, the ray which within the medium of water is required to be inclined at an angle of 60° traverses the coverglass at a much deeper angle, and in the case of the dry lens, this is even more so. Let β be the angle in the coverglass in the case of the dry lens, γ the like angle in the case of the water immersion and δ that in the case of the oil immersion lens; then by the law of refraction, the sines of these angles, and hence the numerical apertures will be related as 1:1.33:1.52, that is in the ratio of the refractive indices of air, water and oil. The ratio of the sines of the three angles within the coverglass, which is strikingly brought out in the diagram, furnishes a correct measure of the resulting intensity of the image and the resolving power of the three objectives. Incidentally, the diagram indicates how greatly all immersion objectives surpass the dry lenses.

The diagram brings out a few other useful aspects affecting the use of the objectives. In order to attain, in practice, the high aperture of which an immersion lens is capable, it follows that the space within N H in the case of the water immersion and within N G in that of the oil immersion, must not be encroached upon by the mount of the objective. The front lens in the oil immersion objective requires, therefore, to be set in a very fine mount. This imposes upon the user the necessity of exercising a certain amount of care, in order that the front lens

may not be forced out of its mounting. **Particular care is required in the use of the 2mm apochromatic objective with the numerical aperture of 1.40, as this is much more finely mounted than the ordinary immersion objective.**

When it is a matter of resolving extremely minute structural elements, where the image is formed by diffraction, the numerical aperture of the objective plays a very significant part in addition to the optical correction of the objective. In the case of stained objects, on the other hand, the image is mainly due to the differentiated absorption, and hence the performance of the microscope is in the main dependent upon the optical correction. When examining stained objects, one should, therefore, give preference to objectives in which an exceptionally high degree of spherical correction has been secured by foregoing a high numerical aperture. Amongst the achromatic objectives, the objective No. 22017, with its numerical aperture of 0.65, is particularly well adapted for histological and cytological observations of this kind. This objective is likewise to be preferred where a flat field is of more importance than the very highest resolution of structural elements.

E: Depth of Focus—Since this optical property of objectives seems to be a point not clearly understood, we deem it advisable to add a few words of explanation. The depth of focus (range of focus or penetrating power) is governed solely by the numerical aperture (N.A.) and the magnification. With the increase of N.A. and the magnification the depth of focus decreases proportionately. It is beyond the optical science to change this prevailing factor. An increase of depth of focus can easily be effected by the insertion of diaphragms above the back lens of the objective, resulting, however, in the decrease of the active diameter of the back lens, followed by the decrease of N.A., ultimately resulting in the decrease of the efficiency of the objective.

It is a known fact that objectives corrected for high definition and resolving power are very sensitive to focusing (slight changes of the fine adjustment screw), due to their decreased depth of focus. **It may be well to emphasize that objectives corrected for increased depth of focus cannot be looked upon as objectives of high efficiency.**

While the resolving power of very minute structures is greatly influenced by the numerical aperture and the correction of the objective, in case of stained preparations, since the image is chiefly dependent upon absorptional action, the condition of correction of the objective is one of chief concern. It is to advantage, therefore, when examining stained specimens, to give preference to those objectives, in which, through sacrifice of numerical aperture, an increased spherical correction has been obtained. An objective especially recommended to suit these requirements is No. 22017 (4mm—45X) N.A. 0.65 (page 16).

F: Achromatic Objectives—The achromatic series of objectives is used chiefly for routine laboratory investigations and for this purpose are fully efficient as to their optical properties relative to chromatic and spherical correction. The latest series of Leitz Achromatic Objectives has been materially improved as regards the flatness of field. For the optical characteristics of these objectives we refer to tables reproduced in this catalog, which give the details of this data. **The advantages derived through the use of the new *"Periplan"* oculars with achromatic objectives of medium and high power will be clearly noticeable.**

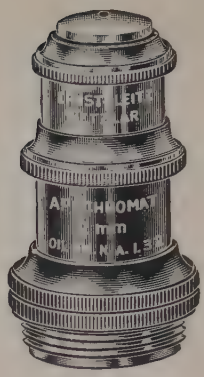
G: Fluorite (Semi-Apochromatic) Objectives—As the designation implies, Fluorite lenses are made use of in the construction of these objectives. In quality the fluorite objectives range between the achromatic and apochromatic series. The Fluorite lenses are selected by the microscopist who desires to obtain objectives of higher color correction and resolving power than is found in achromatic objectives, while at the same time he may be reluctant in regard to the comparatively high price of apochromatic objectives.

The Fluorite series of objectives is likewise recommended for photo-micrography, for which purpose they are highly qualified on account of their excellent optical properties and increased numerical aperture.

For the optical characteristics of these objectives we refer to tables reproduced in this catalog, which give the details of this data.

Apochromat 16mm
(*dry lens*)

Apochromat 4mm
(*dry lens*)



Apochromat 2mm, N.A. 1.32
(*oil immersion*)

H: Apochromatic Objectives—The apochromatic series of objectives surpasses all other types in regard to color correction and resolving power. The increased efficiency in optical properties is due to the use of Fluorite in their construction. Fluorite is characteristic through:

1. High degree of transparency
2. Low refractive index
3. Most favorable conditions in its dispersion properties.

These combined features are not attainable with any artificial medium. The introduction of Fluorite for microscope objectives in 1886 marked a new era in the development of microscopes.

The refractive index of Fluorite is 1.4339 and the reciprocal of the relative dispersion:

$$\nu = \frac{^{n}D}{^{n}F - ^{n}C} = 97$$

whereas with none of the available optical glasses does this value exceed 66.5. Thanks to these low refractive properties it may be made to take the place of crown glass. The combination of Fluorite with a much less refringent glass than any of the usual types of flint glasses furnishes extremely favorable conditions for eliminating spherical aberration. It results, therefore, that the configuration of the spectrum, as produced by a Fluorite prism, is very nearly similar in the relative position of its color bands to that obtained with some of the glasses which are available for use in place of the older flints.

This property furnishes a means of uniting at least **three** optically significant colors, whereas with the older crown and flint pairs it was not possible to bring more than **two** differently colored rays to a focus.

Objectives in which achromatisation does not extend to more than two colors exhibit residual dispersion or what is known as the secondary spectrum. This imperfection is eliminated by bringing about the fusion of more than two colors with the aid of Fluorite.

To summarize the optical features we mention that while in the achromatic objectives the chromatic aberration is corrected for two colors and the spherical aberration generally for one, in the apochromatic objectives the chromatic correction is accomplished for **three** and the spherical for **two** colors, which means that practically all the images produced by the different colors of the spectrum lie in the same plane and are equally sharp.

The high price of apochromatic objectives is due to their complicated formula and to the practical difficulties involved in their manufacture no less than to the scarcity of Fluorite of a quality suitable for optical purposes.

The highest achievement in the construction of microscope objectives is embodied in the 2mm apochromatic oil immersion lens with a numerical aperture of 1.40. We included this objective in our list since we have succeeded in computing a combination in which the front lens can be secured in a fairly firm mount.

Though in apochromatic objectives rays of different colors are brought to a focus in an ideal manner it is not possible to entirely remove the residual difference in the focal length due to different colors, in consequence of which the resulting images are not strictly coincident. This overlapping of the images gives rise to color fringes at the edge of the field. To eliminate this defect a special series of oculars has been introduced under the name of *"Periplan"* oculars. The formula of these oculars admits of still higher magnifications than is practical in the case of *"Huyghenian"* oculars.

With many objects the absence of the secondary spectrum endows the image with a brilliancy which cannot be attained in any of the achromatic objectives. Fine butterflies' scales and diatomaceae are objects which never fail to demonstrate the exquisite qualities of apochromatic objectives. **For the highest type of work in research and photo-micrography, apochromatic objectives are invariably to be selected.**

I: *"Huyghenian"* **Oculars**—The Leitz *"Huyghenian"* oculars are available for use with all Leitz objectives, though they are primarily designed for combination with fluorite and achromatic lenses. Their optical data has recently been modified to secure certain practical advantages.

The series of seven oculars presents now a much more rational progression in their magnifying power. These seven *"Huyghenian"* oculars magnify 4X, 5X, 6X, 8X, 10X, 12X and 16X respectively.

These oculars are so computed as to cause the lower principal focus for all oculars to be **in the same plane,** so that an adjustment which has been made with any one ocular will also hold good for the others. **Any interchange of oculars does accordingly not necessitate any refocusing.** Strictly speaking this holds good for normal (emmetropic) eyes capable of readily accommodating for infinity.

J: *"Periplan"* **Oculars—(A new series of oculars to replace so-called "Compensating" Oculars)—**

FEATURES: Flatness of field to utmost periphery of image
Increase in size of image (up to 50% and over)

The *"Periplan"* oculars serve to eliminate the curved image obtained with microscope objectives and to overcome the attending defects so readily noticeable towards the periphery of these images. Due to this important feature the *"Periplan"* oculars are recommended for use with apochromats and high power fluorite as well as achromatic objectives in preference to other oculars.

The construction of *"Periplan"* oculars approaches the *"Huyghenian"* oculars while the eye lens consists of two lenses and not of one only as in the *"Huyghenian"* type. The eye lens is made of one each negative flint and one positive crown lens, the focal lengths of which have been selected so as to achieve the desired correction of the curved image.

Concerning color correction, the *"Periplan"* oculars possess the same advantages as are identified with compensating oculars, while the defect of image distortion has been eliminated. **The remarkable feature of flatness of field to the periphery of the image is one of special importance for photo-micrography.**

Table Comparing Size of Field Obtained with *"Periplan"* Oculars via Compensating Oculars in Connection with Apochromatic Objective 16mm

	Field of View with Apochromat 16mm		
	***"Periplan"* Oculars**	***"Compensating"* Oculars**	
4X	2.20mm	—	—
5X	2.05mm	1.74mm	4
6X	1.85mm	—	—
8X	1.55mm	1.25mm	6
10X	1.40mm	—	—
12X	1.20mm	0.92mm	8
15X	1.20mm	0.71mm	12
20X	0.85mm	—	—
25X	0.70mm	0.57mm	18

Note: The above table clearly indicates the increased size of field obtained from the use of *"Periplan"* oculars.

ACHROMATIC OBJECTIVES

Optical Data and Prices

Code Word	Cat. No.	Magn. No.	Equivalent Focal Length mm	Type of Objective	Old Designation No.	N.A.	Working Distance mm	Micrometer Value[1]) with Ocular 6X mm	Price
ACROM	21998[2])	1X	56	Dry	0	0.05	55	0.143	$
ACOLL	22000[3])	2.7X	42	Dry	1*	0.08	40	0.058	
AADOEFEL	22001[4])	3.2X	24	Dry	1K	0.08	3.2	0.0445	
ACUBE	22002	3.2X	40	Dry	1	0.12	34.5	0.049	
ACABA	22005	4.3X	32	Dry	1b	0.15	27	0.037	
ACTWO	22003[5])	5-12X	30-16	Dry	1c	0.15-0.25	30-5	0.035-0.016	
ACEDU	22006	6X	24	Dry	2	0.20	16	0.0275	
AADEIACI	22007	8X	20	Dry	2b	0.30	7.7	0.20	
ACORA	22008	10X	16	Dry	3	0.25	5.8	0.0156	
ACODO	22010	14X	13	Dry	3b	0.40	3.2	0.012	
ACLAN	22012	20X	9	Dry	4	0.45	2.0	0.008	
ACATI	22014	30X	6	Dry	5	0.65	0.75	0.005	
ACTIS	22016	45X	4	Dry	6	0.85	0.32	0.0036	
ACMAT	22017[6])	45X	4	Dry	6L	0.65	0.60	0.0036	
ACISE	22018[7])	62X	3	Dry	7	0.85	0.28	0.0025	
WATES	22019	50X	3.6	Water Im.	1/7W	1.00	0.40	0.003	
WATIM	22020	90X	2.1	Water Im.	10	1.20	0.10	0.0018	
OILEX	22021	10X	16	Oil Im.	16mm	0.25	0.65	0.016	
OILAT	22021a	22X	8	Oil Im.	8mm	0.65	0.45	0.008	
OILIM	22022	100X	1.8	Oil Im.	1/12	1.30	0.11	0.0016	

1) Value on the stage of 0.1mm in the focal plane of the ocular.

2) No. 21998 is to be attached directly to the thread of the draw tube.

3) No. 22000 consists of **one** double lens only and therefore offers less light than objectives Nos. 22001 and 22002.

4) In general, the objective No. 22002 is given preference due to its large working distance while if it is preferred to likewise have a low power objective of 3.2X **adjusted to the nosepiece so as to be parfocal with the other objectives**, then the objective No. 22001, having a working distance of 3.2mm, should be selected.

5) No. 22003 represents a divisible objective; by unscrewing the front lens, the remaining unit will render a varying magnification from the combined magnifying power obtained with the entire unit.

6) No. 22017 possesses a long working distance and is especially recommended for blood counting work.

7) Objective No. 22018 can be furnished with coverglass correction collar, **additional charge**, $. (In telegram orders **add "KOFAS"** to code word.)

FLUORITE (SEMI-APOCHROMATIC) OBJECTIVES

Optical Data and Prices

Code Word	Cat. No.	Magn. No.	Equivalent Focal Length mm	Type of Objective	Old Designation No.	N.A.	Working Distance mm	Micrometer Value[8]) with Ocular 6X mm	Price
FLUCA	22024[9])	42X	4.2	Dry	6a	0.85	0.38	0.0038	$
FLUOR	22026[9])	58X	3.2	Dry	7a	0.85	0.28	0.0028	
FLUME	22030[9])	70X	2.6	Dry	8a	0.90	0.25	0.0023	
FLUGO	22032[9])	85X	2.2	Dry	9a	0.90	0.13	0.0018	
FLUIM	22031	54X	3.45	Oil Im.	1/7a	0.95	0.20	0.003	
FLURI	22033	70X	2.6	Oil Im.	1/10a	1.30	0.18	0.0022	
FLUES	22034	95X	1.95	Oil Im.	1/12a	1.32	0.11	0.0017	
FLUXU	22036	114X	1.6	Oil Im.	1/16a	1.32	0.08	0.0014	

8) Value on the stage of 0.1mm in the focal plane of the ocular.

9) Objectives Nos. 22024, 22026, 22030 and 22032 can be furnished with coverglass correction collar, **additional charge**, $. (In telegram orders **add "KOFAS"** to code word.)

APOCHROMATIC OBJECTIVES

Optical Data and Prices

Code Word	Cat. No.	Magn. No.	Equivalent Focal Length mm	Type of Objective	N.A.	Working Distance mm	Micrometer Value[1]) with Ocular 6X mm	Price
APOSA	**22050**	**12X**	**16**mm	Dry	**0.30**	5.0	0.0143	$
APOCT	**22052**	**23X**	**8**mm	Dry	**0.65**	0.85	0.0072	
APOVI	**22054**[2])	**46X**	**4**mm	Dry	**0.95**	0.20	0.0035	
APORE	**22056**[2])	**65X**	**3**mm	Dry	**0.95**	0.15	0.0026	
APOFO	**22058**[3])	**65X**	**3**mm	Oil Im.	**1.32**	0.13	0.0025	
APOTY	**22060**	**65X**	**3**mm	Oil Im.	**1.40**	0.13	0.0025	
APOIM	**22062**	**92X**	**2**mm	Oil Im.	**1.32**	0.11	0.00175	
APOXU	**22064**[4])	**92X**	**2**mm	Oil Im.	**1.40**	0.05	0.00175	

1) Value on the stage of 0.1mm in the focal plane of the ocular.

2) The objectives Nos. 22054 and 22056 are supplied with coverglass correction collar.

3) The immersion No. 22058 is likewise supplied as a special objective for darkfield examination with **N.A. 1.15** (listed under No. 22057, page 30), at $. (Code word **"AAHOENER."**)

4) Even while the mounting of the front lens of objective No. 22064 may be considered exceedingly solid, in view of the extreme numerical aperture, it is nevertheless suggested to exercise utmost care when using the objective in order to preclude displacement of the front lens.

Note: for **Darkfield Examination**, it is necessary that

All Apochromatic Oil Immersion Objectives,
Fluorite Oil Immersion Objectives Nos. 22033, 22034 and 22036,
Achromatic Dry Objectives Nos. 22016, 22017 and 22018,
Water Immersion No. 22020,
Achromatic Oil Immersion No. 22022,

be appropriately reduced in their numerical aperture in order to create sufficient contrast within the darkfield. This is accomplished through the interposition of an objective iris diaphragm; the diaphragm, being mounted within an independent objective body, readily accommodates the lens portion of the objectives above referred to. The objective diaphragm is furthermore used advantageously for binocular vision since thereby the focal depth can be materially increased towards enhancing the perspective value of objectives. (*The Objective Diaphragm is listed under No. 22564a, page 29.*)

MICRO SUMMARS

with Iris Diaphragm

F: 4.5

These photo objectives, being provided with society thread, may be screwed to the thread of the microscope tube. For photo-micrography, utilizing at the microscope the large tube of 50mm diameter, the "Micro Summars" can be used advantageously as wide angle objectives to cover a specimen of extended field. The aperture of the three "Micro Summars" listed below varies from 0.08 to 0.10.

Focal Length: mm	42	35	24
Code Word:	SUMIT	SUMEX	SUMAN
Cat. No.:	**28245**	**28240**	**28238**
Price: $			

No. 22006a

DIVISIBLE OBJECTIVES

The Triple Divisible Objective "Trio" No. 22006a, combines at an attractive price and at considerable saving, the cost of three objectives and a triple nosepiece. The triple divisible objective "Trio" has been constructed for reasons of economy to High and Elementary Schools. **It serves first in a similar capacity as three individual objectives** of different magnifications and secondly **as a triple nosepiece.** Inasmuch as this objective is used in three sections, each set of lenses in a different mounting, provided with a separate hinge, one can successively use one section alone, two together, or the three sections combined. *Magnifications from 34-670X are considered fully sufficient for elementary microscopical studies.*

The Double Divisible Objective "Douo" No. 22005a, **combines at an attractive price and a saving, the cost of two objectives and a double nosepiece.** This objective is similar to the triple divisible unit No. 22006a, except that it consists of two sections only.

Code Word	Cat. No.	Designation	Sections	Magn. No.	Equivalent Focal Length mm	N.A.	Working Distance mm	Price $
AEGXA	**22005a**	"Douo"	a	**6X**	**25**	**0.10**	28	$
			a and b combined	**12X**	**13**	**0.20**	12	
AEGUZ	**22006a**	"Trio"	a	**8.5X**	**18.7**	**0.20**	20	
			a and b combined	**22X**	**8**	**0.40**	5	
			a, b and c combined	**42X**	**4.3**	**0.80**	0.25	

MAGNIFICATION TABLE

Divisible Objectives with *"Huyghenian"* Oculars

Divisible Objectives				*"Huyghenian"* Oculars						
Cat. No.	Designation	Sections	Magn. No.	4X	5X	6X	8X	10X	12X	16X
22005a	"Douo"	a	6X	24	30	36	48	60	70	96
		a and b combined	12X	48	60	72	96	120	140	192
22006a	"Trio"	a	8.5X	34	42	50	67	84	100	135
		a and b combined	22X	88	110	132	176	220	264	352
		a, b and c combined	42X	168	210	250	340	420	500	670

"HUYGHENIAN" OCULARS
Optical Data and Prices

Code Word		Catalog No.		Magn. No.	Equivalent Focal Length mm	Old Designation No.	Price	
Single Oculars	**Pairs** of Matched Oculars	**Single** Oculars	**Pairs** of Matched Oculars				**Single** Oculars	**Pairs** of Matched Oculars
HYKUL	GINUL	**22038**	**22038a**	**4X**	62.5	O	$	$
HYGEN	GIGEN	**22040**	**22040a**	**5X**	50.0	I		
HYZWA	GIZRA	**22042**	**22042a**	**6X**	41.65	II		
HYDRE	GIDRO	**22044**	**22044a**	**8X**	31.25	III		
HYVIR	GIVYR	**22046**	**22046a**	**10X**	25.0	IV		
HYFUN	GIFUN	**22048**	**22048a**	**12X**	20.85	V		
HASOVARA	GAFECORD	**22049**	**22049a**	**16X**	15.62	VI		

"Huyghenian" Ocular 6X with micrometer (listed under No. 22646, page 175), $.
(Code Word: **"HYGMI"**)

"PERIPLAN" OCULARS
Optical Data and Prices

Code Word		Catalog No.		Magn. No.	Equivalent Focal Length mm	Price	
Single Oculars	**Pairs** of Matched Oculars	**Single** Oculars	**Pairs** of Matched Oculars			**Single** Oculars	**Pairs** of Matched Oculars
PERIV	GIRIV	**22065**	**22065a**	**4X**	62.5	$	$
PERFU	GIRFU	**22066**	**22066a**	**5X**	50.0		
PERSE	GIRSE	**22067**	**22067a**	**6X**	41.65		
PEROT	GIROT	**22069**	**22069a**	**8X**	31.25		
PEZEN	GIZEN	**22071**	**22071a**	**10X**	25.0		
PEZWO	GIZOV	**22073**	**22073a**	**12X**	20.85		
PEZUR	GIZUR	**22075**	**22075a**	**15X**	16.65		
PEZAS	GIZAS	**22077**	**22077a**	**20X**	12.5		
PEZIT	GIZIT	**22079**	**22079a**	**25X**	10.0		

"Periplan" Ocular 6X with micrometer (listed under No. 22647, page 175), $.
(Code Word: **"PERMI"**)

MAGNIFICATION TABLE

Achromatic, Fluorite and Apochromatic Objectives
with *"Huyghenian"* and *"Periplan"* Oculars, respectively

Tube Length: 170mm

Image Distance: 250mm

Objectives			*"Huyghenian"* and *"Periplan"* Oculars, respectively										
Cat. No.	Equivalent Focal Length mm	Magn. No.	4X	5X	6X	8X	10X	12X	15X	16X	20X	25X	Character of Objective
21998*	56	1	4	5	6	8	10	12	15	16	20	25	Achromatic
22000*	42	2.7	11	13.5	16	22	27	32	41	43	54	68	Achromatic
22001*	24	3.2	13	16	19	26	32	38	48	51	64	80	Achromatic
22002*	40	3.2											
22005*	32	4.3	17	22	26	34	43	52	65	70	86	108	Achromatic
22003*	30-16	5-12	20-48	25-60	30-72	40-96	50-120	60-144	75-180	80-192	100-240	125-300	Achromatic
22006*	24	6	24	30	36	48	60	70	90	96	120	150	Achromatic
22007*	20	8	32	40	48	64	80	96	120	128	160	200	Achromatic
22008*	16	10	40	50	60	80	100	120	150	160	200	250	Achromatic
22021‡	16	10											
22050*	16	12	50	60	70	95	120	145	180	190	240	300	Apochromatic
22010*	13	14	56	70	84	112	140	168	210	224	280	350	Achromatic
22012*	9	20	80	100	120	160	200	240	300	320	400	500	Achromatic
22021a‡	8	22	88	110	132	175	220	265	330	350	440	550	Achromatic
22052*	8	23	90	115	140	180	230	280	345	370	460	575	Apochromatic
22014*	6	30	120	150	180	240	300	360	450	480	600	750	Achromatic
22024*	4.2	42	168	210	250	340	420	500	630	670	840	1050	Fluorite
22016*	4	45	180	225	270	360	450	540	675	720	900	1125	Achromatic
22017*	4	45											
22054*	4	46	184	230	280	360	460	560	690	720	920	1150	Apochromatic
22019†	3.6	50	200	250	300	400	500	600	750	800	1000	1250	Achromatic
22031‡	3.45	54	215	270	325	430	540	650	810	860	1080	1350	Fluorite
22026*	3.2	58	230	290	350	465	580	700	870	930	1160	1450	Fluorite
22018*	3	62	250	310	375	500	620	750	940	1000	1250	1560	Achromatic
22056*	3	65	260	325	390	520	650	780	975	1040	1300	1625	Apochromatic
22058‡	3	65											
22060‡	3	65											
22030*	2.6	70	280	350	420	560	700	840	1050	1120	1400	1750	Fluorite
22033‡	2.6	70											
22032*	2.2	85	340	425	510	680	850	1020	1280	1360	1700	2130	Fluorite
22020†	2.1	90	360	450	540	720	900	1080	1350	1440	1800	2250	Achromatic
22062‡	2	92	368	460	560	740	920	1120	1380	1480	1840	2300	Apochromatic
22064‡	2	92											
22034‡	1.95	95	380	475	570	760	950	1140	1425	1520	1900	2375	Fluorite
22022‡	1.8	100	400	500	600	800	1000	1200	1500	1600	2000	2500	Achromatic
22036‡	1.6	114	450	570	700	900	1140	1400	1710	1800	2280	2850	Fluorite

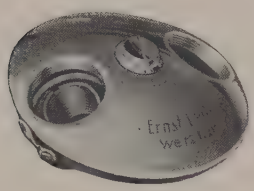
* Dry objectives

† Water immersion objectives

‡ Oil immersion objectives

REVOLVING NOSEPIECES

Revolving nosepieces offer, aside from quick change from one objective to another, the advantage that after one objective has been focused, in changing to others these will likewise be in focus; with objectives of highest power, it being necessary to slightly refocus the fine adjustment. In order to accomplish this sharp focus with each objective attached to the nosepiece, these objectives have been **carefully centered and parfocalized.** Our nosepieces are offered in a dustproof type; no dust can possibly enter upon the back lens of the objectives.

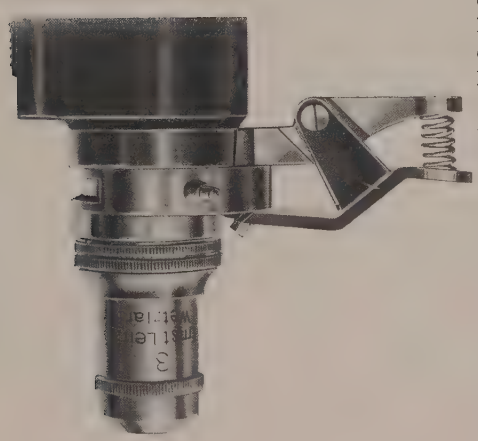


No. 22602

No. 22604

No. 22606

Code Word	Cat. No.	Designation	Price
			$
DUBLO	**22602**	**Double Nosepiece,** revolving, dustproof	
TRIPO	**22604**	**Triple Nosepiece,** revolving, dustproof	
QUATO	**22606**	**Quadruple Nosepiece,** revolving, dustproof	



OBJECTIVE CLUTCH CHANGER

With polarizing microscopes in particular, precise centering of objectives is a matter of importance, and hence these should be provided with an objective clutch changer. Most microscope constructions other than Leitz manufacture, make provisions for centering at either the revolving stage itself or the lower part of the microscope tube, in which case, however, it is necessary to recenter the objective repeatedly whenever a different objective is used.

With the construction of the Leitz new objective clutch changer of patented design, the necessity of continuously recentering the objective does not arise. The individual centering collars are provided with a centering device having two screws manipulated by watch keys; after the collar is once centered, it remains permanently centered for the particular objective and the watch keys are withdrawn to preclude means of accidentally decentering the objective. The centering collars are placed over a steel cone at the clutch and are rigidly held in place by a strong clamp.

Code Word	Cat. No.	Designation	Price
			$
PIZAN	**5620**	**Three-Point Objective Clutch Changer,** patented, with one set of watch keys	
PIZUT	**5621**	**Centering Objective Collar,** for No. 5620	

SUBSTAGE MECHANISMS AND CONDENSERS

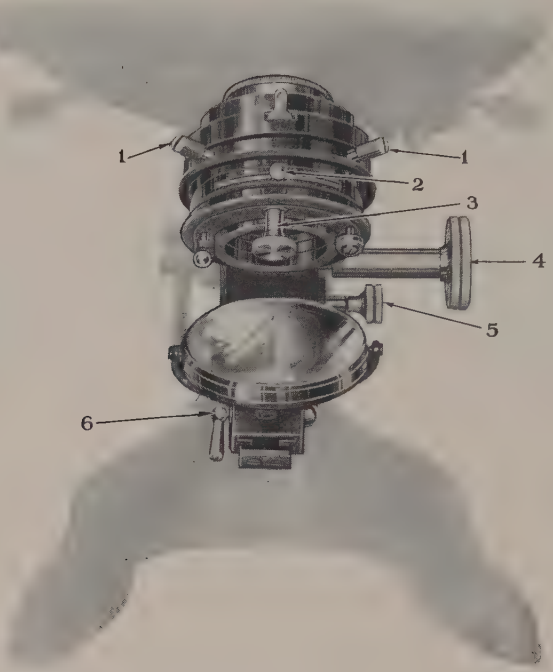
The most convenient means of regulating the illumination of an object which is to be viewed by transmitted light under the microscope is furnished by the *Abbe's* Illuminating Apparatus. The larger patterns of our microscope stands are provided with this illuminator, while the stands of intermediate size have a simplified substage or are fitted with provisions by means of which it may be added at any future time.

The illuminating apparatus are of various more or less elaborate forms to suit general and special requirements and differ in size according to the microscope stands for which they are designed. Moreover, the substage fittings may be provided with condensers differing in their apertures and their optical correction. Condensers of high aperture afford a means of bringing out the full resolving power of an objective and possess the further advantage that they are available for the purpose of producing dark ground illumination within a limited ratio.

When used dry, i.e., without the interposition of an immersion fluid, the condensers cannot have a greater numerical aperture than 1.0 since rays inclined beyond a certain limit are totally reflected. For ordinary observation in transmitted light the dry condenser amply suffices and has the advantage of being simple and easy to manipulate. In more exacting cases, where it becomes necessary to employ the full aperture of the condenser, the gap between the latter and the object slide should be filled with a layer of cedarwood oil. Under these conditions it is most desirable to have the object embedded in a highly refracting medium to obviate total reflection at the upper surface of the object slide. Spherical and chromatic correction have an important bearing upon results in photo-micrography and observation by the method of dark ground illumination where much depends upon the absence of color and the brightness of the field.

148463

Substage "aa" (The Microscope "IURM" is equipped with Substage "aa.")



Designation of numbered parts

1) *Centering screws for condenser.*
2) *Handle for iris diaphragm.*
3) *Handle for leaf diaphragm, for oblique illumination.*
4) *Rack and pinion coarse focus for substage.*
5) *Micrometer fine adjustment for substage.*
6) *Clamping lever for mirror.*

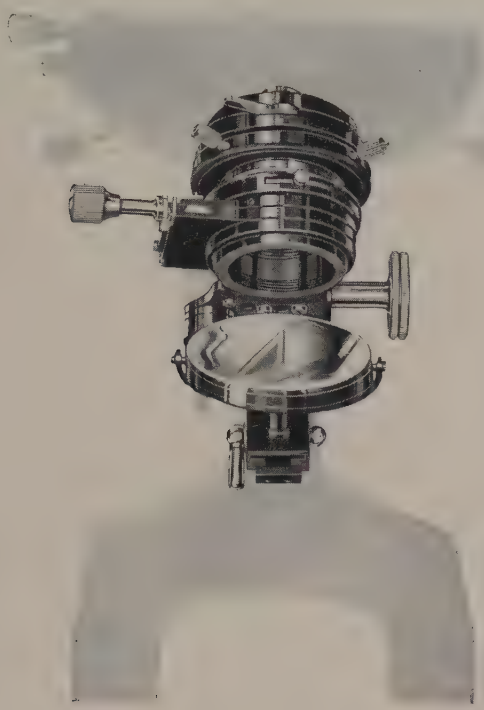
The substage "aa" is provided with a rack and pinion for coarse focus of the illuminating rays. **Inasmuch as the best illumination and the attending perfect definition of the microscope objectives is only accomplished if the light rays from the condenser are brought to a sharp and accurate focus at the plane of the object, we have equipped the substage "aa" with a micrometer focus mechanism as well as with a centering device for the condenser.** For accurate work as required in research investigations, it is essential that the condenser be focused and centered as carefully as is required with the objective.

The centering adapter for the condenser slides into the substage sleeve and is rigidly held in place by means of an eccentric acting lever. Utilizing an adapter ring, included with the substage equipment, any of our objectives used as condensers screw into the centering adapter. The iris diaphragm is attached to the lower surface of the centering adapter and carries a holder for ray filters. When the microscope is to be used without condenser, a cylinder stage iris diaphragm is substituted which orients itself slightly below the stage surface.

The substage is furthermore provided with a device for oblique illumination. Through the use of handle "3," the leaves of the diaphragm are utilized in such manner that they produce results opposite to those of the standard condenser iris. These leaves move to one side and produce oblique light within any desired degree. For reasons that the leaves are embedded in a ring which rotates within 360°, the obliquity of the rays can be achieved from any azimuth and this under an increased volume of light.

Code Word	Cat. No.	Designation	Price
ILABE	**22450**	**Large Substage "aa"**, equipped with **two-lens** condenser **N.A. 1.20** No. 22481	$
ILACA	**22452**	**Large Substage "aa"**, equipped with **three-lens** condenser **N.A. 1.40** No. 22485	
ILADT	**22454**	**Large Substage "aa"**, equipped with **aplanatic-achromatic** condenser **N.A. 1.40** No. 22489	

Substage "b" (The Microscopes of the "A," "C" and "D" series are equipped with the substage "b.")



The large illuminating apparatus "b" consists of the following parts: plano and concave mirror of 50mm diameter above which is mounted a carrier supplied with an iris diaphragm provided with rack and pinion movement for oblique illumination; the iris diaphragm is provided with a rotatable fitting and the bracket supporting it permits the iris to be swung to one side. The upper portion of the substage "b" carries a sleeve into which slides a centering adapter; to the latter may be screwed any condenser of the series we supply. The sleeve is provided with an eccentric acting lever, allowing the condenser to be rigidly clamped in place.

Underneath the iris diaphragm is provided a recess for the accommodation of glass filters and substage "b" includes one each filter white-ground and blue-ground for use with artificial light.

Substage "b" is fitted with vertical rack and pinion movement by means of which the illuminating rays are focused in an axial direction to the most advantageous position relative to the plane of the object.

Code Word	Cat. No.	Designation	Price
ILAEF	**22460**	**Large Substage "b",** equipped with **two-lens** condenser **N.A. 1.20** No. 22480	$
ILAFH	**22462**	**Large Substage "b",** equipped with **three-lens** condenser **N.A. 1.40** No. 22484	
ILAGM	**22464**	**Large Substage "b",** equipped with **aplanatic-achromatic** condenser **N.A. 1.40** No. 22488	

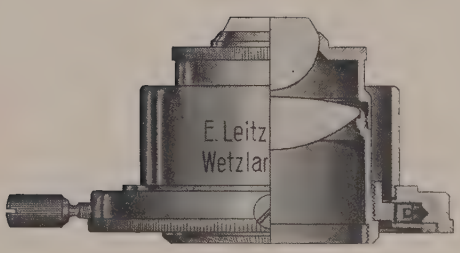
Simplified Substage "c" (The Microscopes of the "L" series as well as the models "DT" and "BRN" are equipped with substage "c.")

The simplified substage "c" consists of the following parts: frame with spring sleeve for the accommodation of the condenser; rack and pinion movement for raising and lowering the substage; adjustable plano and concave mirror of 50mm diameter (the mirror listed in connection with the substage "c" is not included in the price since it is to be considered part of the microscope stand); one each filter white-ground and blue-ground which are to be made to rest upon the swing-out ring attached to the iris diaphragm.

Code Word	Cat. No.	Designation	Price
			$
ILAHB	**22470**	**Simplified Substage "c"**, equipped with **two-lens** condenser **N.A. 1.20** No. 22482	
ILAIV	**22472**	**Simplified Substage "c"**, equipped with **three-lens** condenser **N.A. 1.40** No. 22486	
ILAJO	**22474**	**Simplified Substage "c"**, equipped with **aplanatic-achromatic** condenser **N.A. 1.40** No. 22490	

Note: If the substage "c" is desired with joint at the condenser to permit it to be quickly swung aside, affording a rapid change from observation with or without condenser, the substage "c" may be equipped in such manner, at **additional price** of $. (In telegram orders **add "JOINT"** to code word.)

DIVISIBLE SUBSTAGE CONDENSERS

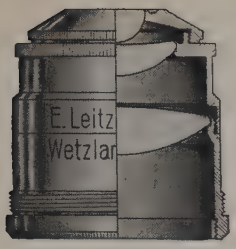


Two-Lens Condenser N.A. 1.20

(Screwed to centering adapter)

The two-lens condenser N.A. 1.20 (*known as "Abbe" condenser*) represents the conventional type of condenser unit chiefly used in connection with microscopes for routine laboratory work. This condenser is neither chromatically nor spherically corrected but for ordinary work, fully sufficient. Depending upon in which substage the condenser N.A. 1.20 is to be utilized, it is furnished either with or without iris diaphragm.

Using the two-lens condenser as dry condenser, without the interposition of cedarwood oil, its numerical aperture is 1.00. Placing a drop of cedarwood oil on the front lens of the condenser and establishing immersion contact with the micro slide, the numerical aperture is thus increased to 1.20.



Three-Lens Condenser N.A. 1.40

In general construction, the three-lens condenser resembles the preceding type except that it consists of three lens units. Using the three-lens condenser as a dry condenser, its numerical aperture is 1.0 while when placing cedarwood oil between condenser and slide, it renders a numerical aperture of 1.40. This condenser can be used with excellent results in the examination of objects imbedded in a highly refracting medium. Utilizing in conjunction with it the center iris diaphragm No. 22546 or the center stop No. 22548, it is available for darkfield illumination within restricted limits.

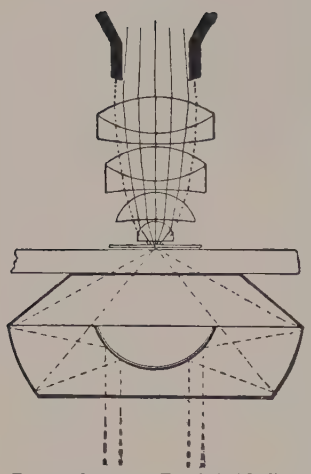
Aplanatic-Achromatic Condenser N.A. 1.40

The aplanatic-achromatic condenser N.A. 1.40 follows in its construction the principle of oil immersion objectives and like these is chromatically and spherically corrected, and consequently satisfies the "sine" condition. Its focal length being 8.5mm and the working distance 1.2mm, the use of object slides up to 1.2mm thick is admitted. This condenser is capable of extensive and varied application. In ordinary observations, it may serve as a dry condenser of N.A. 1.0, and it offers **special advantages in photo-micrography,** owing to its uniform and **color-free illumination.** When used as an immersion condenser at N.A. 1.40, it may be made the means of obtaining a very wide angle or very oblique illuminating pencil. Its great light-gathering power is of considerable practical advantage in observation under high magnifications. As illuminator in photo-micrography, it reduces the requisite time of exposure by approximately 30%. When used in conjunction with center stops placed upon the diaphragm carrier, it constitutes a rather efficient darkfield condenser furnishing an illuminating pencil ranging in numerical aperture from 1.1 to 1.4.

As a result of its very high degree of aplanatic and achromatic correction, the image as seen in the ocular is remarkably free from colors and the defects caused by diffraction and refraction.

Code Word	Cat. No.	Designation	Price
ILKAR	22480	**Two-Lens Condenser,** N.A. 1.20, **without** iris diaphragm, *for use with substage "b"*	$
ILAKD	22481	**Two-Lens Condenser,** N.A. 1.20, **without** iris diaphragm, *for use with substage "aa"*	
ILALU	22482	**Two-Lens Condenser,** N.A. 1.20, **with** iris diaphragm, *for use with substage "c"*	
ILTIR	22484	**Three-Lens Condenser,** N.A. 1.40, **without** iris diaphragm, *for use with substage "b"*	
ILAMS	22485	**Three-Lens Condenser,** N.A. 1.40, **without** iris diaphragm, *for use with substage "aa"*	
ILANY	22486	**Three-Lens Condenser,** N.A. 1.40, **with** iris diaphragm, *for use with substage "c"*	
ILPEN	22488	**Aplanatic-Achromatic Condenser,** N.A. 1.40, **without** iris diaphragm, *for use with substage "b"*	
ILAOP	22489	**Aplanatic-Achromatic Condenser,** N.A. 1.40, **without** iris diaphragm, *for use with substage "aa"*	
ILAPN	22490	**Aplanatic-Achromatic Condenser,** N.A. 1.40, **with** iris diaphragm, *for use with substage "c"*	
		SUBSTAGE ACCESSORIES	
CYLIS	22542	**Cylinder Stage Iris Diaphragm,** fitting the spring sleeve of all substages listed	
IRISA	22544	**Iris Diaphragm,** by means of screws attachable to substage condensers, former type	
ILARC	22545	**Iris Diaphragm,** with thread to attach to substage condensers listed	
ZENTI	22546	**Center Iris Stop,** for darkfield illumination in conjunction with substage condensers Nos. 22484-22490	
ZETRO	22548	**Center Stop,** with three interchangeable stops, for darkfield illumination in conjunction with substage condensers Nos. 22480-22490	
POCON	22547	**Centering Adapter,** consisting of a cylindrical mount in which operates a steel cone by means of centering screws; any of the Leitz condensers are available to be screwed into the thread of the steel cone and thus are made to serve as centerable condensers. (The centering adapter slides into the sleeve of all substages listed)	

BI-CENTRIC DARKFIELD CONDENSERS



Rays through Darkfield Condenser and Oil Immersion Objective 100X, No. 22022

This catalog describes Darkfield Condensers only briefly, and for complete details and technical data we refer to our special PAMPHLET No. D-2064.

Since the introduction of Leitz darkfield condensers, **they have enjoyed the reputation of superiority due to rendering a PERFECT CONTRAST.** Comparatively recently, the full line of Leitz darkfield condensers has been further enhanced through increasing their optical efficiency and the latest models are known as **"BI-CENTRIC REFLECTING CONDENSERS."** This series surpasses all existing forms both in respect to light-transmitting capacity and attainable resolving power. The advanced results achieved by the use of the bi-centric condensers may easily be conceived from the two photo-micrographs illustrated below.

With the new darkfield condensers, the greatest admissible viewing aperture is only 0.05 below the aperture limit (1.20) of the standard substage condensers. If desired, we are prepared to furnish darkfield condensers of a still lower limiting aperture for investigations in which the resolving power outweighs every other requirement. In any case, however, the maximum value which is admissible should be 0.05-0.10 below the refractive index of the embedding medium. Neither the increased intensity of the light nor the enhanced resolving power which results from the use of the bi-centric darkfield condensers becomes manifest unless **objectives of a numerical aperture exceeding 1.0 are employed.** Failing this, all that will be perceived will be an accentuated contrast in image.

Since observation in darkfield demands as an absolute necessity a certain minimum measure of contrast which, moreover, depends to a great extent upon the thickness and density of the preparation, it is invariably desirable to employ **the objective adapter with iris diaphragm No. 22564a** (listed on page 29), even in those cases where objectives especially adapted for darkfield work are used. The objective adapter with iris diaphragm affords a ready means of establishing a most favorable condition for observation as regards contrast and resolving power according to the peculiarities of any object. This applies also in particular to binocular vision concerning the stereoscopic perception of depth.

We offer the bi-centric darkfield condenser in two different focal lengths. The models **"A"** and **"B"** have shorter focal lengths and are available for use with all microscope stands including those of smallest stage openings. As a consequence of the short focal length, the illuminating field within the object is comparatively small and hence it is necessary to center the condenser carefully. The use of these condensers is in the main restricted to the objectives of higher powers. The bi-centric condenser model **"AA"** as well as the combination condenser model **"D"** are provided with long focal lengths and consequently furnish a larger illuminating field within the preparation. These two condensers, therefore, do not require centering and they may moreover be used in conjunction with the objectives of high as well as low power. The light concentrating capacity is identical in all models.

The bi-centric condensers, with the exception of model "B" slide into the sleeve of the substage frame in place of the ordinary condenser. **It should be observed that the darkfield condensers reach sufficiently high into the substage frame so as to make the front lens of the condenser fall into the level with the upper surface of the microscope stage.** Failing this, it will not be possible to obtain a darkfield of perfect contrast. *(Since some of the microscope stands have undergone modification in their constructional details, the serial number of the particular stand on which the darkfield condenser is to be used should be mentioned in the order.)*

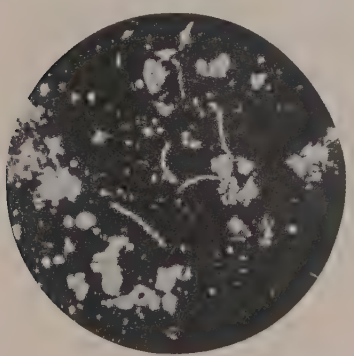


Photo-Micrograph of "spirochaete pallida" as viewed with the Leitz Darkfield Condenser in conjunction with the Special Apochromatic Oil Immersion Objective 60X N.A. 1.15 (No. 22057)

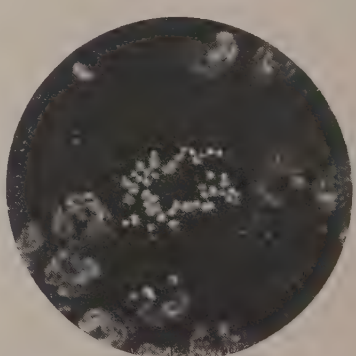
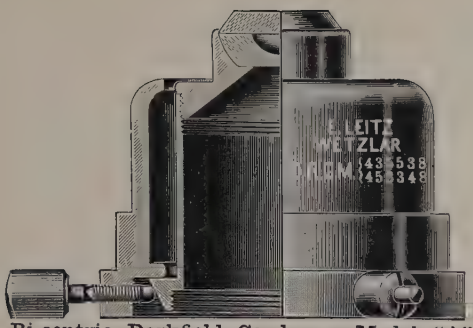
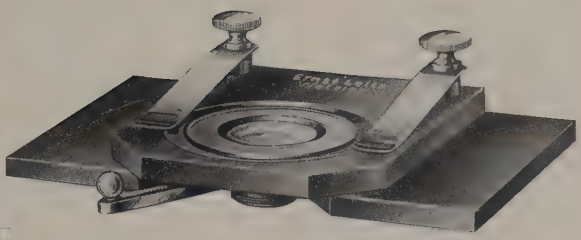


Photo-Micrograph of "gonococci" stained with methylene blue, as viewed with the Special Apochromatic Oil Immersion Objective 60X N.A. 1.15 (No. 22057)

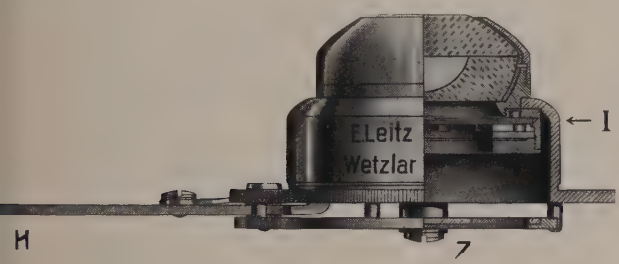


Bi-centric Darkfield Cendenser Model "A"
(*Attaches to the substage of the microscope*)



Bi-centric Darkfield Condenser Model "B"
(*Is placed upon the microscope stage*)

The **Model "B"** condenser is mounted within a plate, fitted with object clips. In this form the condenser is simply placed upon the microscope stage and is held in place by the stage clips. When using the darkfield condenser "B" it has to be observed that the regular substage condenser is first withdrawn. Model "B" does not require special adaptation and can be used in connection with any existing microscope, therefore, it is particularly useful in those cases when a microscope is either not of Leitz make or the prevalent circumstances render it impracticable to forward the substage for adaptation of the condenser model "A." The mounting of the lens unit is provided with a handle serving the purpose of slightly raising or lowering the glass unit of the darkfield condenser "B" for the purpose of adjusting the light rays to overcome the variation in the thickness of object slides.



Bi-centric Bright and Darkfield Condenser Model "D"
(*Combination Condenser*)

The condenser **Model "D,"** producing a very satisfactory darkfield, affords at the same time, means of rapid transition from darkground to brightfield illumination and furthermore, it permits a specimen to be observed simultaneously under dark and brightfield. Model "D," being a combination condenser, through its use, renders the microscope available for alternate application under regular trans-illumination or for the examination of specimens in darkfield. The model "D" can well be termed "Two Condensers in One" and through its acquisition, the standard *"Abbe"* condenser will not be required.

Darkfield Condenser Model "E"

of High Light Intensity

for Use with Objectives of Low Power

Darkfield Condenser Model "E"

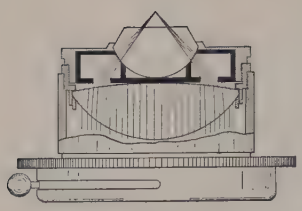
Darkfield condenser model "E" is endowed with a high degree of light intensity, has long working distance, and is offered for use with low power objectives.

It fits the sleeve of the standard substage and by means of the rack and pinion of the latter is made to establish correct focus towards the specimen; its correct focus is then accomplished when a maximum of intensity has been obtained. Dependent upon the source of light utilized, either the plano or concave surface of the substage mirror is required.

The condenser "E" is available for use with the objectives Nos. **22002, 3.2X** (40mm), **22006, 6X** (24mm), and **22008, 10X** (16mm); introducing into the condenser the screen diaphragm supplied with it, the condenser is likewise available for use with objectives Nos. **22010, 14X** (13mm) and **22012, 20X** (9mm).

Condenser model "E" is exceptionally well adapted for instantaneous exposure in photo-micrography as well as cine-photo-micrographic work; due to its high degree of light transmitting power, the condenser is furthermore ideally suited for projection in darkfield. The long working distance permits examining objects of considerable thickness and at the same time, the application of heating or cooling devices.

Note: For prices, refer to page 28.



Substage Condenser with darkfield diaphragm inserted

The **Darkfield Diaphragm** is a device for obtaining darkfield illumination with the standard type two-lens substage condenser. When unscrewing the upper lens unit of the substage condenser, the diaphragm is placed into the condenser mounting on top of the lower lens (*see illustration*), and then the upper lens unit is screwed back into position. The upper metal ring of the diaphragm restricts the upper border aperture and thereby precludes total reflection, while the cylindrical ring resting against the under surface of the front lens restricts the lower border aperture of the condenser. Both rings are mounted together by means of vertical supports. The effective darkfield rays pass through the ring-shaped opening of the diaphragm and thus a useful darkfield is obtained.

Illustrating Objective Body with Funnel Stop No. 22564 and lens unit of Oil Immersion Objective screwed to the Funnel Stop

Darkfield Chamber

This chamber has been designed for use with darkfield condensers and affords the following advantages: **1.** It carries a glass chamber of correct thickness and consequently insures proper illumination and contrast; **2.** It safeguards the plano parallel position of both the slide and coverglass, thus avoiding deformation and deflecting rays; **3.** Through the use of the clips furnished with the chamber, the layer of the specimen is always adjusted to the correct thickness, thus a maximum contrast in the darkfield is obtained.

After the examination is completed and the spring clips are released, the glass chamber is easily removed from its metal mounting for cleaning. For more or less extensive series of observations, it is suggested to order a number of glass chambers to be used alternately within the metal mounting.

DARKFIELD CONDENSERS AND ACCESSORIES

Code Word	Cat. No.	Designation	Price
CONCI	**22558**	**Bi-centric Darkfield Condenser, Model "A",** in centering mount, for use in the microscope substage, **in case**	$
COUAB	**22559**	**Bi-centric Darkfield Condenser, Model "A",** same as No. 22558 but **made of "U-V" Crown glass,** for the transmission of ultra-violet light, **in case**	
COUCY	**22561**	**Bi-centric Darkfield Condenser, Model "A",** same as No. 22558 but **made of quartz, in case**	
CONFY	**22560a**	**Bi-centric Darkfield Condenser, Model "B",** for use on the microscope stage, **in case**	
CONDU	**22562a**	**Bi-centric Darkfield Condenser, Model "AA",** for use in the substage of Leitz Microscopes of later design having substage condenser of large diameter (*Model "AA" is furnished without centering screws since these are not required*), **in case**	
CONRO	**22563a**	**Bi-centric Bright and Darkfield Condenser (Combination Condenser) Model "D",** for use in the substage of Leitz Microscopes of later design having substage condenser of large diameter (*Model "D" is furnished without centering screws since these are not required*), **in case**	
CAKAPETO	**22557**	**Darkfield Condenser, Model "E",** of high light-transmitting capacity for use with low power objectives, **in case**	

(*Continued on page 29*)

DARKFIELD CONDENSERS AND ACCESSORIES (continued)

Code Word	Cat. No.	Designation	Price
DABCF	**22564**	**Objective Body with Funnel Stop** (used with oil immersion objectives to reduce them to proper numerical aperture for darkfield work).....	$
IRTIS	**22564a**	**Objective Body with Iris Diaphragm** (this device should be given preference over No. 22564 for reasons that it permits the numerical aperture of objectives to be varied at will and consequently renders all objectives of high numerical aperture available for darkfield work).....	
LABGU	**22567**	**Darkfield Diaphragm,** *for use with two-lens condenser N. A. 1.20,* described on page 28.....	
KAMRA	**22564b**	**Chamber** for darkfield illumination, with one glass cell, six glass coverglasses, **in case**.....	
KAMFI	**22564c**	**Glass Cell,** extra, for No. 22564b.....	
KAMLO	**22564d**	**Coverglasses,** made of **glass,** extra, for No. 22564b (**set of six**)**per set**	
KAMZU	**22564e**	**Quartz Cell,** for No. 22564b, with three quartz coverglasses.....	
KAMDE	**22564f**	**Coverglass,** made of **quartz,** extra, for No. 22564e.....**each**	
IRMUZ	**22566**	**Azimuth Diaphragm,** for the determination of the form of ultra-microns (*When ordering, the model of condenser should be named and in case of later delivery for use with older types of dark field condensers, it is necessary that the condenser be sent to us.*).....	

LAMPS RECOMMENDED FOR DARKFIELD ILLUMINATION

Code Word	Cat. No.	Designation	Price
LILAM	**32700**	**Arclamp,* hand-feed pattern,** 4-5 amp., on adjustable support, with illuminating lens in focusing mount, with 10-ft. cord and plug, but without rheostat or transformer (see page 161).....	$
LIUHR	**32720**	**Arclamp,* automatic-feed pattern,** 4-5 amp., with clockwork mechanism, on adjustable support, with illuminating lens in focusing mount, with 10-ft. cord and plug, but without rheostat or transformer (see page 161)..... **Note:** *Depending upon the current conditions, either a rheostat or transformer is required with above arclamps and for the selection of these as well as carbons for use with the arclamps refer to page 161.*	
MONLA	**32800**	**Special Microscope Lamp,*** consisting of stand, housing, "Nitra" lamp bulb 6-volt, 5-amp., collimator illuminating system, complete **without** filters, rheostat or transformer, with 6-ft. cord and plug..... **Note:** *Lamp No. 32800 is to be used with rheostat or transformer depending upon current conditions; for full description of this lamp and for selection of rheostats and transformers, refer to page 162.*	
STEBE	**32900**	**Microscope Lamp "Stella",*** mounted to inclinable support, complete with **100-watt bulb,** including 6-ft. cord and plug..... **Note:** *This lamp does not require a rheostat.*	
STEDO	**32904**	**Microscope Lamp "Stella",*** mounted to inclinable support, complete with **250-watt bulb,** including 6-ft. cord and plug..... **Note:** *For full description of lamps Nos. 32900 and 32904, refer to page 164.*	
RADIT	**3880**	**"Radio" Lamp,*** with 100-watt gas-filled bulb **110-volt,** 6-ft. cord and plug.....	
RADTO	**3890**	**"Radio" Lamp,*** with 100-watt gas-filled bulb **220-volt,** 6-ft. cord and plug..... **Note:** *For full description of lamps Nos. 3880 and 3890 refer to page 163.*	
DALIT	**3940**	**"Daylite" Filter,** for lamps Nos. 3880 and 3890.....	
DABLA	**22581**	**Microscope Lamp "Mignon",*** complete with 6-ft. cord, plug and one extra lamp bulb..... **Note:** *For full description of lamp No. 22581 and selection of rheostats and transformers, refer to page 164.*	

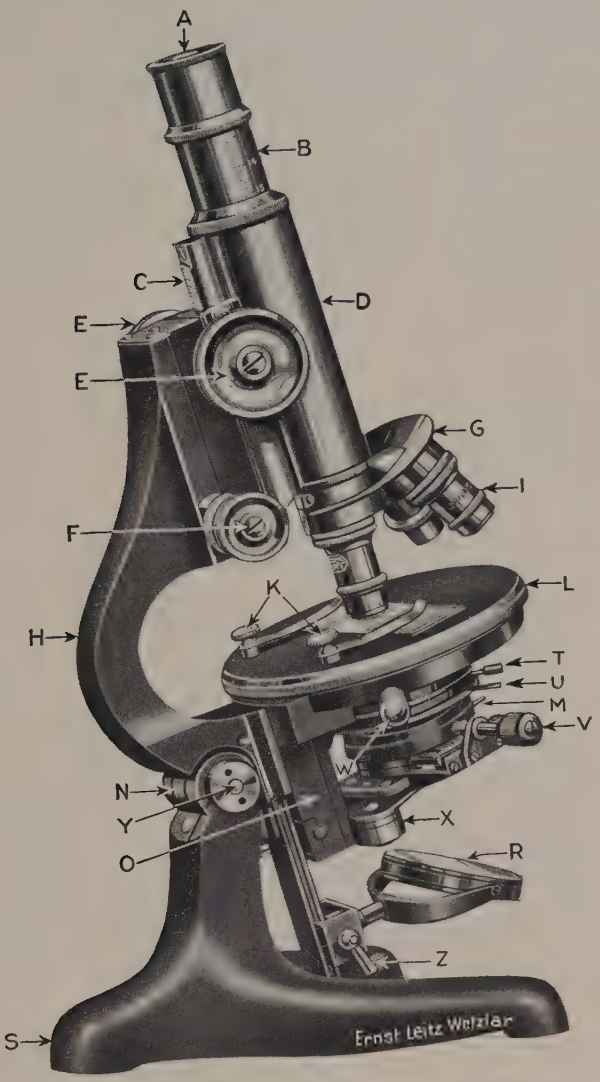
* When ordering please state current.

IMMERSION OBJECTIVES FOR DARKFIELD ILLUMINATION

For use with the various models bi-centric darkfield condenser, an immersion objective has been especially designed. This objective has been arranged with the numerical aperture as large as is usable with these darkfield condensers so as not to impair the contrast and definition. As previously explained, when applying the standard immersion objectives for darkfield, the funnel stops No. 22564 or 22564a respectively (page 29) are to be utilized. The special immersion objective listed below is of reduced numerical aperture and consequently eliminates the common difficulty experienced in the manipulation encountered to obtain satisfactory dark-ground illumination, since this objective does not require a funnel stop.

Code Word	**Cat. No.**	**Magn. No.**	**Equivalent Focal Length** mm	Type of Objective	**N.A.**	Working Distance mm	Micrometer Value(1) with Ocular 6X mm	**Price**
AAHOENER	**22057**	**60X**	**3.2**	Apochromatic Oil Im.	**1.15**	0.28	0.0027	$

1) Value on the stage of 0.1mm in the focal plane of the ocular.



Index to Above Illustration

A—Ocular.
B—Draw Tube with Millimeter Scale.
C—Rack for Coarse Focus.
D—Body Tube.
E—Pinion Heads for Coarse Focus.
F—Fine Adjustment Head for Micrometer Screw.
G—Revolving Nosepiece for Objectives.
H—Handle Arm.
I—Objectives.
K—Stage Clips.
L—Stage.
M—Substage Illuminating Apparatus.
N—Inclination Joint.
O—Substage Rack and Pinion.
R—Mirror.
S—Base (Foot).
T—Handle for Manipulating the Stage-Diaphragm.
U—Handle for Manipulating the Condenser-Diaphragm.
V—Oblique Illumination Device.
W—Stage Screw for Mechanical Motion.
X—Joint of Substage.
Y—Tightening Nut.
Z—Clamping Lever for Mirror.

MECHANICAL CONSTRUCTION OF MICROSCOPE STANDS

The Leitz Microscopes are of the handle arm type which represents the most practical and at the same time, best balanced design. **The Leitz Works are credited with the innovation of the handle arm pattern in microscopes** while other manufacturers followed this construction.

In connection with each microscope listed in this catalog, we have itemized the individual specifications for each stand. So as to comprehend the specifications much better than the brief individual description will convey, we give in the following, further details in respect to the mechanical construction. In Leitz Microscopes, the governing principle for precision mechanical workmanship has been followed most carefully and particular care has been exercised to have the bearing surfaces made of two metals of unequal hardness whereby utmost smoothness of action and long service is guaranteed.

Base—Of *horseshoe* design is used with every Leitz Microscope and this rests on three points representing an exceedingly convenient form as well as rigid support for the microscope. In some of the microscope models, as will be noted from the illustrations, the horseshoe base is slightly modified and has round contours, but in every other respect all the features as well as the rigidity of the horseshoe pattern are maintained. The construction is so well balanced that microscopes equipped with inclination joint will remain firmly supported even if inclined to 90° from the vertical axis.

Pillar—As the illustrations of the individual microscope stands will imply, the pillars are of either round or square pattern and large as well as rigid enough to insure permanent alignment to the microscope. Sufficiently high, the pillars afford ample space for the manipulation of the substage. The microscope stage is supported high enough to avoid shading the mirror by its forward edge. The inclination joint has the tapered axle carefully ground, permitting the microscopes to be inclined within a ratio of 90°, stops being provided at both the vertical and horizontal positions, the joint being fitted sufficiently accurately so that the stand retains its inclined position at any spot of its inclination ratio.

Arm—Is of the *curved* type characterized by the exceptionally large space it provides for the manipulation of objectives as well as specimens. Being of the handle arm pattern, the arm serves as a convenient means for carrying the instrument by hand, not imparting any strain upon the microscope adjustments.

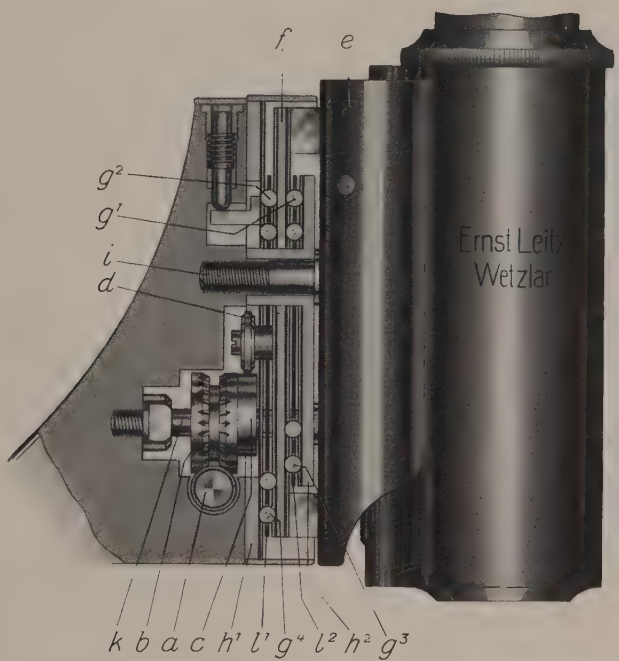
Body Tube and Draw Tube—The body tubes are machined with utmost precision to insure the required accuracy for maintaining the optical parts true to axis. The diameter of the tubes varies with the size of the microscope stand and the tube measurements are individually mentioned with each microscope.

Tubes of large diameter are designed to meet the requirements arising in photo-micrography and drawing with objectives of wide angle type or if standard micro objectives are used without oculars. The microscope models of the "LL" and "O" series are provided with the tube of fixed length, automatically retaining the correct distance between ocular and objective. The microscopes of all other series, however, are equipped with the standard size draw tube, graduated in millimeters to indicate the mechanical tube length from the point at which the ocular rests to the thread into which the objective screws, **the graduations being calibrated including the height of the revolving nosepiece.** The draw tube slides within a smooth bronze bushing, no lining having been provided so as to insure an even movement and to prevent the settlement of particles upon the back lenses of objectives, a feature which cannot be claimed with draw tubes moving within a felt lining.

Nosepiece—Is offered for a convenient and quick change from one objective to another. When we supply microscopes equipped with nosepieces, the objectives we furnish are carefully parfocalized and adjusted to the optical center so that when swinging from one objective to another, each objective is focused to an extent that only a slight manipulation of the micrometer screw is required for a sharp focus of the image. The nosepieces are available in three different forms viz., for two, three or four objectives. Each nosepiece is thoroughly dustproof and arranged in construction to hold the objectives at an angle so that no interference with the specimen is possible when a change from one objective to another takes place.

Coarse Focusing Adjustment—The coarse focus of the microscope is attained through rack and pinion movement, the teeth of which are cut diagonally. The smooth movement of the coarse focusing mechanism is accomplished through the precise fitting of rack and pinion. The rack slides have their gliding surfaces carefully ground to insure long service and the pinion bearing provides an arrangement for readjustment after long service.

Micrometer Fine Adjustment—With the exception of the microscopes of the "L" series, all Leitz microscope stands are equipped with **the new ball bearing micrometer screw** of patented design. (*U. S. Patent No. 1,429,557.*)



It is only too well known that the satisfactory performance of a microscope greatly depends upon the construction of the micrometer fine adjustment since even the minutest error and faulty movement in its workmanship is correspondingly magnified with the magnification under which the microscope is used. No matter how carefully the sliding surfaces of a micrometer mechanism are fitted, with years of use a certain amount of wear and tear may be expected. Realizing that in conjunction with most sensitive movements when one has to depend on correct functioning, the mechanical industry of precision resorts to ball bearings so as to reduce friction, ***the Leitz Works have constructed a new micrometer movement with perpendicular ball bearing track.***

The Leitz ball bearing fine adjustment has been used with most gratifying results since by means of the ball bearing track, the micrometer movement is not exposed to any friction. With this micrometer device, **lubricants do not at all play any part of importance,** because due to the ball bearings, the movement of the microscope tube follows with rapid speed the movement of the micrometer screw even if it is burdened by tubes of extraordinary weight.

The new micrometer device, utilizing ball bearing tracks, guarantees the most precise functioning of the micrometer screw for unlimited time.

The underlying principle of construction is easily noticeable from the illustration on page 33. The micrometer screw itself represents the well-known Leitz micrometer fine adjustment, utilizing a worm gear thread (a) engaging upon a gearing wheel (b), the latter being fastened to a steel disc having two identical curves (c); upon these curves rests the wheel (d). This wheel, by way of an axle is attached to the tube part (e) by means of the guiding plate (f). This guiding plate, through the use of pairs of balls (g^1) and (g^2) as well as (g^3) and (g^4), moves between stationarily locked guarding plates (h^1) and (h^2). The screw (i) as well as the axle (k) connect the stationary guarding plates (h^1) and (h^2) to the arm of the microscope; the axle (k) at the same time supporting the gear wheel (b) with steel curves (c). The guarding plates are provided with two grooves within which eight pairs of balls are made to glide. The individual balls are maintained at the correct distance from each other by means of plates (l^1) and (l^2). The latter carry appropriate recesses for the balls to rest in. The guarding plates are made of hardened steel and are most carefully fitted and ground truly plano-parallel. Likewise, the balls consist of glass-hardened steel and are made with minutest precision.

The ball bearing fine adjustment is provided with micrometer heads of two different reading capacities. The microscopes of the "A" series are equipped with a micrometer head of which one interval corresponds to a vertical displacement of the tube within 0.001mm while the micrometer head of the microscopes of the "C" series permits control of the vertical movement of the tube within 0.002mm.

The microscopes of the "L" series are equipped with a micrometer screw of similar construction as the one previously described, however, it dispenses with the ball track movement. For many decades, the Leitz Microscopes have been supplied with this micrometer movement and even under strenuous use have withstood the most exacting requirements. The micrometer device with which the microscopes of the "L" series are equipped reaches a positive stop at each end of the complete excursion. The micrometer drum of microscopes of the "L" series is so graduated that one interval corresponds to a vertical displacement of the tube within 0.004mm.

The two fine adjustments described are provided with a safety device through which the movement ceases to act immediately when the objective touches the slide and thus injury to objectives and specimens is precluded.

Stage—In size, the stages range consistent with the size of the microscope stand to which they are attached, and being amply large, they afford a convenient manipulation of large specimens, Petri dishes, etc. The exact measurements of the stage are given in conjunction with the individual description of each microscope. With the exception of microscope "O," all stages of the Leitz Compound Microscopes are completely covered with vulcanite. Full guarantee is offered against the stage surfaces warping. The stages are sufficiently heavy and rigid in their construction to avoid vibration under use of high power objectives.

Substage—These are supplied by us in four different forms; viz., the simplified type into which the condenser slides; again, another simplified model which focuses by means of rack and pinion (substage "c" described on page 24); the microscopes of the "A" and "C" series are equipped with the complete substage "b" (described on page 23), and finally do we offer the complete substage "aa" (described on page 22). Detailed description has been given of these substages on the pages referred to.

Mirror—We supply these mounted in frame furnished with one each plane and concave surfaces of 50mm diameter, being adjustable in two directions. With the microscopes of large type, the mirrors are attached to the substage support while in the remaining models they are mounted to a swinging arm for oblique illumination.

Finish—So as to preserve the microscopes against external influences caused by wear and tear as well as chemical fumes, the utmost care is exercised in preparing the metal surfaces with durable lacquer. The lacquer used consists of a composition which has proven highly satisfactory under most trying circumstances and all climatic conditions. The body tube, arm, base and pillar of all compound microscopes are finished in black and the adjusting heads in colorless lacquer. All lacquered parts are thoroughly alcohol-proof.

Case—The cabinets for all microscopes of large design are finished in mahogany wood while the cases of the other microscopes consist of hardwood, all being supplied with lock and key. The cabinets as well as cases are carefully treated to be impervious to moisture. While the more expensive cabinets are highly polished, the others are carefully lacquered.

STANDARD OPTICAL EQUIPMENTS

On account of an almost unlimited range of possible optical combinations, it is difficult to make recommendations on equipments suitable for every individual requirement. We deem it advisable to limit ourselves, therefore, in listing below a number of standard equipments which are used most frequently and which have proven well assorted in objectives and oculars for the field of investigation for which they are recommended. It is, of course, understood that from the list of objectives and oculars enumerated on pages 16-18, any suitable equipment can be assorted and added to the price of the bare stand listed in connection with each microscope. *It is suggested, since a microscope is in the great majority of cases purchased only once in a lifetime, not to economize on the microscope stand proper but rather to cut down in the initial optical equipment and to supplement it at any future time.* For research and photo-micrography, we recommend the microscopes of the "A" series equipped with apochromatic objectives and *"Periplan"* oculars. For advanced laboratory work, consideration may be given to the microscopes of the "C" series equipped with either apochromatic or fluorite objectives and *"Periplan"* or *"Huyghenian"* oculars. For general laboratory investigations, any of the other microscope stands equipped with achromatic objectives and *"Huyghenian"* oculars, will fully suffice.

If a prospective purchaser would indicate to us the nature of his requirements, we shall be pleased to assist him in the selection of a suitable equipment.

Note: We are not prepared to supply microscope stands without optics excepting on special terms only.

Code Word	Objectives	Oculars	Combined Magnification	Price For **Monocular** Microscopes (**Single** Oculars)	Price For **Binocular** Microscopes (**Paired** Oculars)
	Standard Equipment No. 10a *(For Routine Laboratory Investigation)*				
OPEAM	**22008, Achromatic** (*Dry*), 16mm, N.A. 0.25, **Magn. 10X** **22017, Achromatic** (*Dry*), 4mm, N.A. 0.65, **Magn. 45X** **22022, Achromatic** (*Oil Im.*), 1.8mm, N.A. 1.30, **Magn. 100X**	**22042, "Huyghenian", 6X** **22046, "Huyghenian", 10X**	60-1000X	$	$
	Standard Equipment No. 13 *(For Routine Laboratory Investigation)*				
OPEBY	**22001, Achromatic** (*Dry*), 24mm, N.A. 0.08, **Magn. 3.2X** **22008, Achromatic** (*Dry*), 16mm, N.A. 0.25, **Magn. 10X** **22017, Achromatic** (*Dry*), 4mm, N.A. 0.65, **Magn. 45X** **22022, Achromatic** (*Oil Im.*), 1.8mm, N.A. 1.30, **Magn 100X**	**22040, "Huyghenian", 5X** **22044, "Huyghenian", 8X** **22048, "Huyghenian", 12X** **22049, "Huyghenian", 16X**	16-1600X		
	Standard Equipment No. 15a *(For Routine and Advanced Laboratory Investigation)*				
OPECT	**22008, Achromatic** (*Dry*), 16mm, N.A. 0.25, **Magn. 10X** **22017, Achromatic** (*Dry*), 4mm, N.A. 0.65, **Magn. 45X** **22034, Fluorite** (*Oil Im.*), 1.95mm, N.A. 1.32, **Magn. 95X**	**22042, "Huyghenian", 6X** **22046, "Huyghenian", 10X**	60-950X		
	Standard Equipment No. 20a *(For Advanced Laboratory Investigation)*				
OPEDE	**22008, Achromatic** (*Dry*), 16mm, N.A. 0.25, **Magn. 10X** **22024, Fluorite** (*Dry*), 4.2mm, N.A. 0.85, **Magn. 42X** **22034, Fluorite** (*Oil Im.*), 1.95mm, N.A. 1.32, **Magn. 95X**	**22042, "Huyghenian", 6X** **22046, "Huyghenian", 10X**	60-950X		

Note: *The Objectives and Oculars are listed individually on pages 16-18.*

Code Word	Objectives	Oculars	Combined Magnification	Price For **Monocular** Microscopes (**Single** Oculars)	Price For **Binocular** Microscopes (**Paired** Oculars)
	Standard Equipment No. 22 *(For Advanced Laboratory Investigation)*				
OPEER	**22001, Achromatic** (*Dry*), 24mm, N.A. 0.08, **Magn. 3.2X** **22008, Achromatic** (*Dry*), 16mm, N.A. 0.25, **Magn. 10X** **22024, Fluorite** (*Dry*), 4.2mm, N.A. 0.85, **Magn. 42X** **22034, Fluorite** (*Oil Im.*), 1.95mm, N.A. 1.32, **Magn. 95X**	**22040, "Huyghenian", 5X** **22044, "Huyghenian", 8X** **22048, "Huyghenian", 12X** **22049, "Huyghenian", 16X**	16-1520X	$	$
	Standard Equipment No. 30a *(For Research and Photo-Micrography)*				
OPEFO	**22050, Apochromatic** (*Dry*), 16mm, N.A. 0.30, **Magn. 12X** **22054, Apochromatic** (*Dry*), 4mm, N.A. 0.95, **Magn. 46X** **22062, Apochromatic** (*Oil Im.*), 2mm, N.A. 1.32, **Magn. 92X**	**22069, "Periplan", 8X** **22075, "Periplan", 15X**	95-1380X		
	Standard Equipment No. 35a *(For Research and Photo-Micrography)*				
OPEGI	**22050, Apochromatic** (*Dry*), 16mm, N.A. 0.30, **Magn. 12X** **22052, Apochromatic** (*Dry*), 8mm, N.A. 0.65, **Magn. 23X** **22054, Apochromatic** (*Dry*), 4mm, N.A. 0.95, **Magn. 46X** **22062, Apochromatic** (*Oil Im.*), 2mm, N.A. 1.32, **Magn. 92X**	**22067, "Periplan", 6X** **22073, "Periplan", 12X** **22077, "Periplan", 20X**	70-1840X		
	Standard Equipment No. 37 *(For Research and Photo-Micrography)*				
OPEKS	**22001, Achromatic** (*Dry*), 24mm, N.A. 0.08, **Magn. 3.2X** **22050, Apochromatic** (*Dry*), 16mm, N.A. 0.30, **Magn. 12X** **22052, Apochromatic** (*Dry*), 8mm, N.A. 0.65, **Magn. 23X** **22054, Apochromatic** (*Dry*), 4mm, N.A. 0.95, **Magn. 46X** **22058, Apochromatic** (*Oil Im.*), 3mm, N.A. 1.32, **Magn. 65X** **22062, Apochromatic** (*Oil Im.*), 2mm, N.A. 1.32, **Magn. 92X**	**22066, "Periplan", 5X** **22069, "Periplan", 8X** **22073, "Periplan", 12X** **22075, "Periplan", 15X** **22077, "Periplan", 20X**	16-1840X		
	Standard Equipment No. 39 *(Elaborate Assortment for Research and Photo-Micrography)*				
OPELA	**22001, Achromatic** (*Dry*), 24mm, N.A. 0.08, **Magn. 3.2X** **22050, Apochromatic** (*Dry*), 16mm, N.A. 0.30, **Magn. 12X** **22052, Apochromatic** (*Dry*), 8mm, N.A. 0.65, **Magn. 23X** **22054, Apochromatic** (*Dry*), 4mm, N.A. 0.95, **Magn. 46X** **22058, Apochromatic** (*Oil Im.*), 3mm, N.A. 1.32, **Magn. 65X** **22062, Apochromatic** (*Oil Im.*), 2mm, N.A. 1.32, **Magn. 92X** **22064, Apochromatic** (*Oil Im.*), 2mm, N.A. 1.40, **Magn. 92X** **22036, Fluorite** (*Oil Im.*), 1.6mm, N.A. 1.32, **Magn. 114X**	**22066, "Periplan", 5X** **22069, "Periplan", 8X** **22073, "Periplan", 12X** **22075, "Periplan", 15X** **22077, "Periplan", 20X**	16-2280X		

Note: *The Objectives and Oculars are listed individually on pages 16-18.*

Pages 38 to 85 cover our complete line of

BIOLOGICAL MICROSCOPES

MON-OBJECTIVE BINOCULAR MICROSCOPES

for Single Objectives

The Leitz Works are credited as being the originators of Binocular Microscopes for high power work. They first introduced these models in 1913 and other manufacturers have since found it necessary to offer similar constructions. Since the Leitz Binocular Microscopes are patented (*U. S. Patent No. 1,448,592*), the Leitz Works **FULLY EXPECT TO RETAIN THE PRESTIGE FOR THE ORIGINAL PATTERN, ITS FEATURES AND SUPERIORITY.**

Ever since the introduction of optical appliances, the aim has been to make them useful for both eyes. Originally no special reason was known for doing so, but the fact that two eyes give better vision than one.

While a few microscopes for binocular vision developed, the early instruments were made for low power only. The images, being of unequal illumination, caused considerable eye-strain. "Greenough's" Binocular Microscope with paired objectives (thus giving a stereoscopic image), came into use in 1897 and met with success.

Taking all factors into consideration, none of the older constructions solved the problem of a binocular microscope for high power work. In order to approach the ideal, it was necessary to construct an instrument that was capable of utilizing the perfect objectives already in existence, without reducing their numerical aperture, supplying to both images equal illumination.

With this in mind, the Leitz **"Mon-Objective Binocular"** microscope came into existence. The usual microscope tube has been replaced by a flat chamber containing various prism units. The prisms are of high quality, and so perfectly calculated that no noticeable loss of light is experienced; in fact, when both eyes are used, the image obtained is considerably brighter than when an ordinary microscope is employed.

The oculars are mounted parallel to each other. This is a very important innovation and affords complete relaxation of the eyes. Notwithstanding the repeated directions given, to leave the eye at rest, not to accommodate, when using a microscope, this is a difficult task to perform. To look convergently and not to accommodate is against nature, as these two functions are automatically interdependent.

When using a monocular microscope, the eye not employed is more easily fatigued. While the occupied eye is focused upon the specimen, remaining at a given distance, the unused eye receives constantly changing images and it requires considerable energy to disregard them. The microscopic image in the employed eye is a constant invitation for the unemployed one to converge towards it and to accommodate accordingly. Early fatigue is the unavoidable result. After a brief period the keenness of perception diminishes. Intervals of rest constantly increasing in length, have to be taken frequently. Microscopic observation becomes hard work. **This is also the case when using binocular microscopes having the oculars arranged in an angle to each other.**

The main advantage of the new **Leitz Binocular** Microscope is the **complete elimination of eye-strain** and the reducing of eye fatigue. One is thus enabled to attend to microscopic investigations for much longer periods in a most convenient and agreeable manner. Especially is this true when observations with darkfield condensers or other high power work is undertaken. Viewed through the **Leitz Binocular** Microscope, the **quality of image is indeed remarkable.** The object appears much clearer, more details being noticeable than with the ordinary monocular microscope.

It is very rare that both eyes have the same keenness of perception. One eye may be more sensitive to color, the other to minute details. In binocular vision it is possible for them to compensate one another, utilizing their optical qualities to the fullest extent. In making use of both eyes at the same time these faculties combine, increasing the distinctness and brilliancy of the image con-

siderably. Comparing a monocular image with one obtained through the **Leitz Binocular** Microscope, the impression of seeing more clearly is unmistakable. The object seems to have more vigor, more life. **Binocular** vision adds a sensation of depth, plasticity and richness unattainable with the monocular microscope.

After delineating the possibilities and effect obtained with the **Leitz Binocular** Microscopes, we deem it advisable to summarize the advantages:

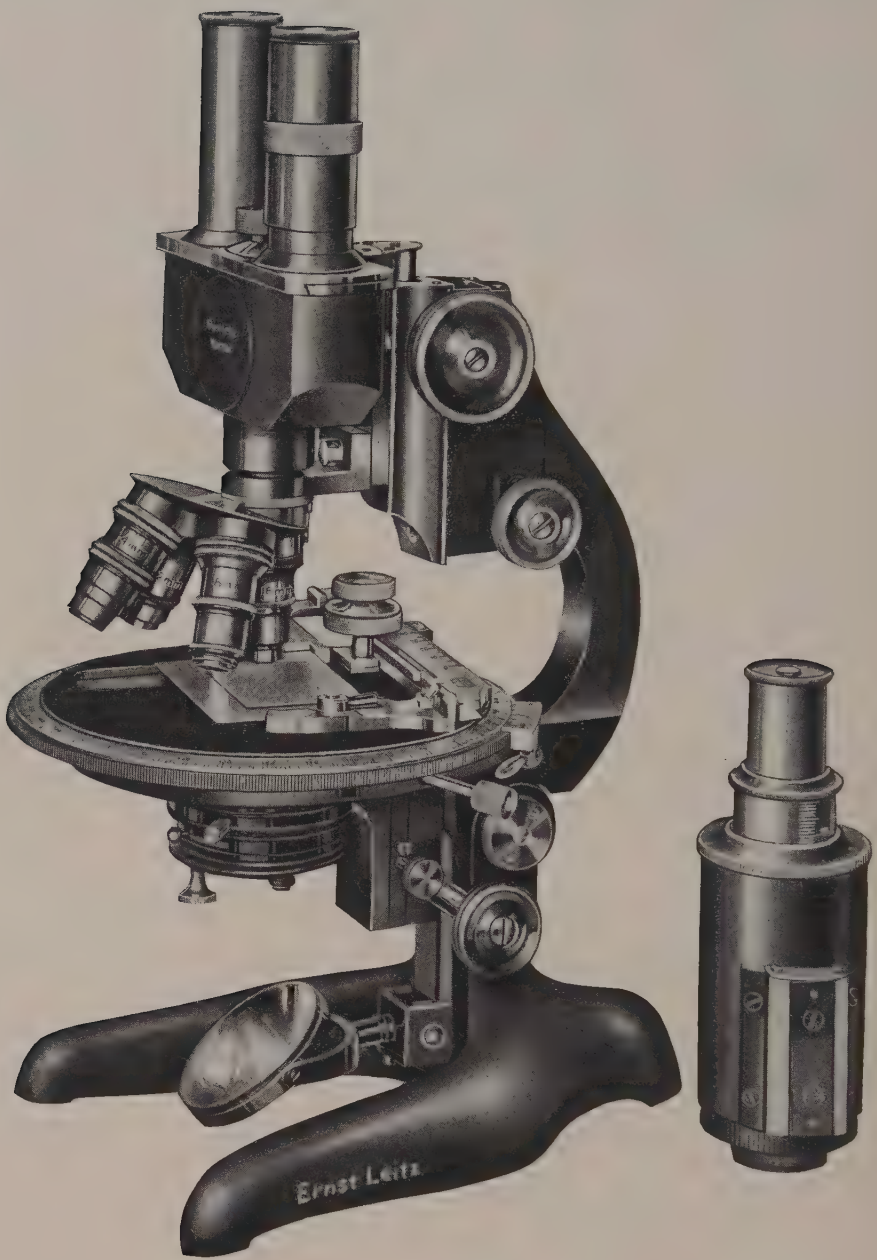
1. Immediately convertible from binocular to monocular vision or vice versa.
2. Binocular body tube for binocular vision.
3. Monocular body tube for monocular vision and photo-micrography.
4. Perfect adjustment of the oculars by rack and pinion with graduated scale to any interpupillary distance.
5. Adjustment of ocular tubes to any difference in refraction between the eyes.
6. Complete elimination of eye-strain; restful to the eyes.
7. Improved quality of image.
8. Oculars are mounted parallel, **not convergent, as in other constructions.**
9. Any favored objective can be utilized, from the lowest power dry to the highest power oil immersion.
10. *"Periplan"* and *"Huyghenian"* oculars of various focal lengths are adaptable.
11. The full numerical aperture of the objectives is maintained.
12. All the features of the regular monocular microscope are embodied.
13. Special nosepiece adapter, mounted to microscope stand, independent of the body tubes, **maintains the objectives permanently centered, regardless if binocular or monocular body tubes are used.**

As stated, prolonged observations with the monocular microscope are very fatiguing. For this reason the **Leitz Binocular** Microscope will appeal to the research microscopist, who has hoped that some day a binocular instrument of perfection would be at his disposal to aid him in his work.

INTERCHANGEABLE ACCESSORIES

for Microscope "IURM" and the models of the "A" Series

Code Word	Cat. No.	Designation	Price
ABMVX	**22842**	**Binocular Body Tube, without** objectives, oculars or nosepiece.....	$
ABMNS	**22844**	**Monocular Body Tube,** 50mm diameter, **without** objectives, oculars or nosepiece.....	
ABBLI	**22846**	**Monocular Body Tube with Side Telescope,** for photo-micrography, permitting constant observation of image when microscope is connected with camera, **without** objectives, oculars or nosepiece.....	
ABMIB	**22605**	**Detachable Nosepiece Adapter,** with **triple** dustproof nosepiece....	
ABMPF	**22607**	**Detachable Nosepiece Adapter,** with **quadruple** dustproof nosepiece	
ABMLA	**22623**	**Plain Circular Stage,** 125mm diameter, supplied with centering screws (listed on page 169).....	
ABDJE	**22611**	**Rotary Mechanical Stage,** 125mm for slides up to size 50x75mm (listed on page 169).....	
ABMXE	**22611a**	**Rotary Mechanical Stage,** 153mm diameter, graduated periphery in 360 divisions, vernier reading to 3 minutes of the arc (listed on page 170)	
ABMSU	**22612**	**Mechanical Stage,** standard pattern, large size, for slides up to size 50x100mm—this stage can be used only with the plain circular stage No. 22623—(listed on page 171).....	



IMPROVED UNIVERSAL RESEARCH MICROSCOPE "IURM"

Combination Model for Binocular and Monocular Vision

U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube and Rotary Mechanical Stage No. 22611a attached, showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "IURM"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 50mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as the draw tube are detachable for use with wide angle objectives; i.e., "Micro Summars." **The monocular body tube converts microscope "IURM" for monocular vision and for use in photo-micrography.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—153mm diameter; circular pattern, provided with centering screws, revolvable, with clamping device to arrest rotation when desired; mechanical movement by rack and pinion in two directions, scales divided in millimeters and verniers facilitate reorientation of specimens; slides 50 x 75mm may be examined from corner to corner. The stage is provided with a graduated periphery, carrying 360 divisions and vernier permitting reading to 3 minutes of the arc. It is designed so that oil does not come in contact with the stage when immersion contact between condenser and slide is established. The mechanical motion device is removable for use of plain stage surface with large specimens. (*For further details, see No. 22611a, page 170.*)

Substage—Model "aa" (*described on page 22*).

Base, Pillar and Arm—The **base** is of extra large modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical position. The **arm** is of heavy curved form providing ample space for large specimens.

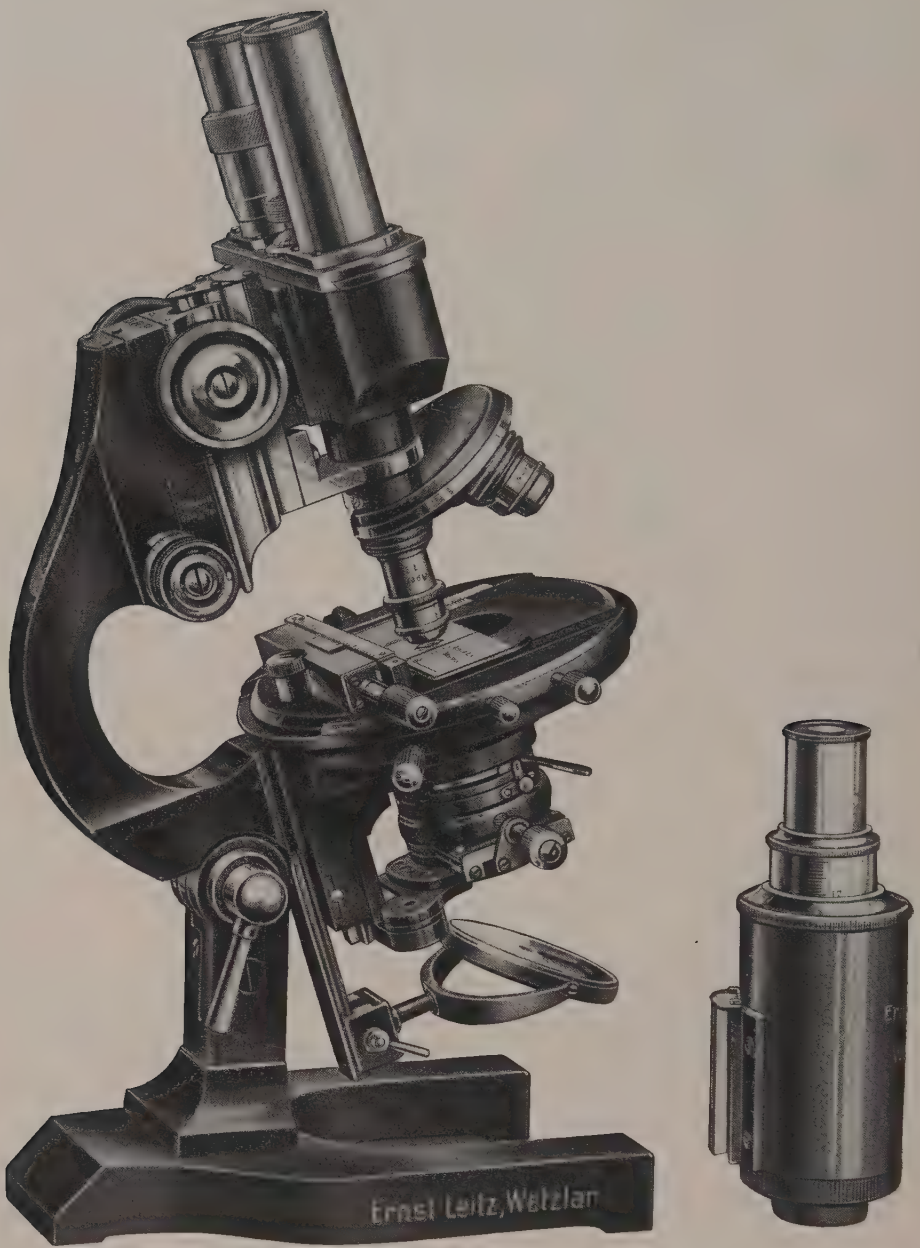
Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
MERJM	**IURM-13**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16—1600X*)	**$**
MERTZ	**IURM-22**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16—1520X*)	
MERCE	**IURM-30a**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95—1380X*)	
MERDY	**IURM-35a**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70—1840X*)	
MERVX	**IURM-37**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16—1840X*)	
MERXR	**IURM-39**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16—2280X*)	
MERZM	**IURM-40a**	**Microscope "IURM",** including substage "aa" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The monocular body tube is regularly included; if not desired, **deduct** $.....



COMBINATION MICROSCOPE "AABM"

for Binocular and Monocular Vision

U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube and Rotary Mechanical Stage No. 22611 attached, showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "AABM"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 50mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as the draw tube are detachable for use with wide angle objectives; i. e., "Micro Summars." **The monocular body tube converts microscope "AABM" for monocular vision and for use in photo-micrography.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—125mm diameter; circular pattern, provided with centering screws, revolvable, with clamping device to arrest rotation when desired; mechanical movement by rack and pinion in two directions, scales divided in millimeters and verniers facilitate reorientation of specimen; slides 50 x 75mm may be examined from corner to corner. It is designed so that oil does not come in contact with the stage when immersion contact between condenser and slide is established. The mechanical motion device is removable, leaving large plain surface with one rack movement for use with large specimens. (*For further details, see No. 22611, page 169.*)

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of extra large horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

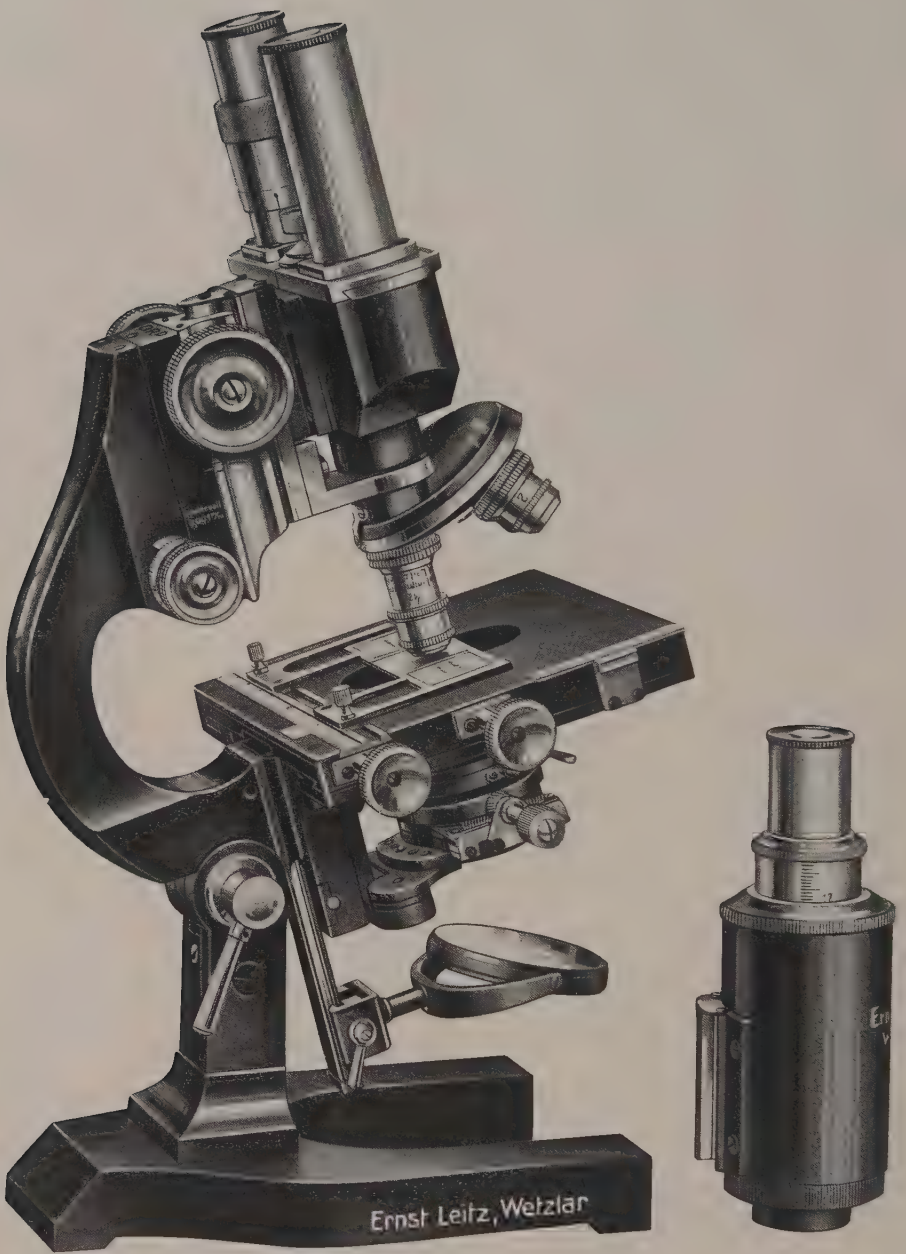
Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
ADAAQ	**AABM-13**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*)..	$
ADABZ	**AABM-22**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*)..	
ADACH	**AABM-30a**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*)..	
ADADS	**AABM-35a**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)..	
ADAEV	**AABM-37**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16-1840X*)..	
ADAFM	**AABM-39**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16-2280X*)..	
ADAGA	**AABM-40a**	**Microscope "AABM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: 1) **The monocular body tube is regularly included; if not desired, deduct $.**

2) **If microscope "AABM" is desired with revolving plain stage in place of mechanical stage, deduct $.**



COMBINATION MICROSCOPE "ABMT"
for Binocular and Monocular Vision

U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube and Mechanical Stage No. 22613 attached,
showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "ABMT"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 50mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as the draw tube are detachable for use with wide angle objectives; i. e., "Micro Summars." **The monocular body tube converts microscope "ABMT" for monocular vision and for use in photo-micrography.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered**, regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square pattern, *combined mechanical and plain,* of metal, covered with vulcanite; measures 120 x 120mm. The sideward motion is controlled by a worm screw drive, the backward and forward motion by rack and pinion, covering a range of 31 x 51mm respectively. The screw heads are located at the right-hand side and do not obstruct the stage proper. Removing the arms holding the slide converts the stage to a plain surface with complete mechanical motions. Each movement is provided with scales divided in millimeters and verniers facilitate reorientation of specimens. (*For further details see No. 22613, page 171.*)

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of extra large horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
ADAHJ	**ABMT-13**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600 X*)..	$
ADAIB	**ABMT-22**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520 X*)...	
ADAJN	**ABMT-30a**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380 X*)..	
ADAKK	**ABMT-35a**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840 X*)..	
ADALF	**ABMT-37**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16-1840 X*)..	
ADAMP	**ABMT-39**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16-2280 X*)..	
ADANC	**ABMT-40a**	**Microscope "ABMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The monocular body tube is regularly included; if not desired, **deduct** $.

COMBINATION MICROSCOPE "ABMS"
for Binocular and Monocular Vision
U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube attached,
showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "ABMS"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 50mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as the draw tube are detachable for use with wide angle objectives; i. e., "Micro Summars." **The monocular body tube converts microscope "ABMS" for monocular vision and for use in photo-micrography.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 125 x 125mm; provided with stage clips.

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of extra large horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
ADAOG	**ABMS-13**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*)..	$
ADAPL	**ABMS-22**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*)..	
ADAQY	**ABMS-30a**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*)	
ADARX	**ABMS-35a**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)..	
ADAST	**ABMS-37**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16-1840X*)..	
ADATU	**ABMS-39**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16-2280X*)..	
ADAUR	**ABMS-40a**	**Microscope "ABMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	
ABMSU	**22612**	**Mechanical Stage,** regular type, large pattern, permitting objects in size of 50x100mm, for microscope "ABMS".....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The monocular body tube is regularly included; if not desired, **deduct $.**

COMBINATION MICROSCOPE "CCBM"
for Binocular and Monocular Vision
U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube and Rotary Mechanical Stage No. 22611b attached, showing Monocular Body Tube detached

(Microscope "CCBM" is slightly smaller in design than Model "AABM")

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "CCBM"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. **The monocular body tube converts microscope "CCBM" for monocular vision.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.002mm and consequently permits accurate measurements of the thickness of specimens.

Stage—112mm diameter; circular pattern, provided with centering screws, revolvable, with clamping device to arrest rotation when desired; mechanical movement by rack and pinion in two directions; scales divided in millimeters and verniers facilitate reorientation of specimen; slides 25x75mm may be examined from corner to corner. It is designed so that oil does not come in contact with stage when immersion contact between condenser and slide is established. The mechanical motion device is removable, leaving large plain surface with one rack movement for use with large specimens. (*For further details, see No. 22611b, page 169.*)

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

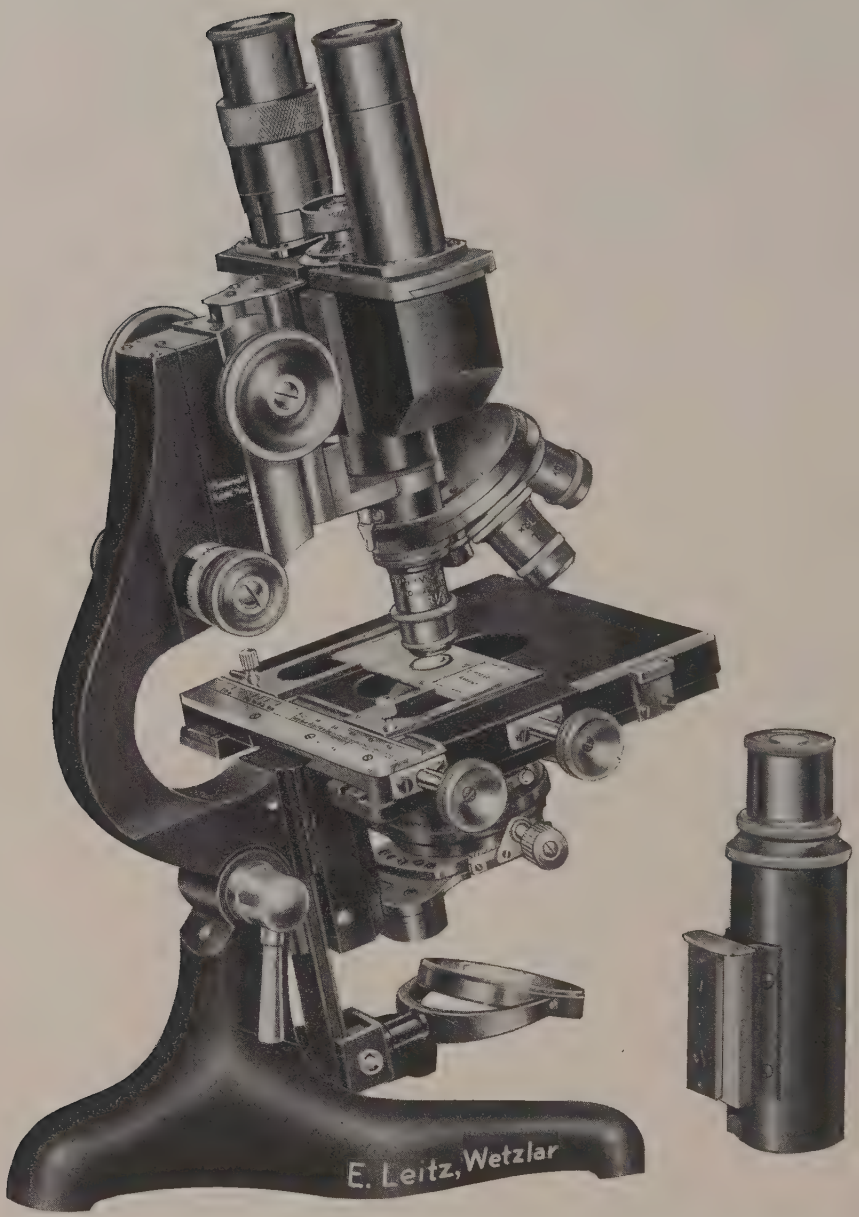
Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
ADAVO	**CCBM-10a**	**Microscope "CCBM",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*).....	$
ADAWD	**CCBM-13**	**Microscope "CCBM",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*).....	
ADAXI	**CCBM-22**	**Microscope "CCBM",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*).....	
ADAYW	**CCBM-30a**	**Microscope "CCBM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*).....	
ADAZE	**CCBM-35a**	**Microscope "CCBM",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)..	
AGOAQ	**CCBM-40a**	**Microscope "CCBM",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, **without** objectives or oculars.....	

* *These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: 1) The monocular body tube is regularly included; if not desired, **deduct** $.

2) If microscope "CCBM" is desired with revolving **plain** stage in place of mechanical stage, **deduct** $.



COMBINATION MICROSCOPE "CBMT"
for Binocular and Monocular Vision
U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube and Mechanical Stage No. 22613 attached,
showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "CBMT"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. **The monocular body tube converts microscope "CBMT" for monocular vision.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.002mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square pattern, *combined mechanical and plain,* of metal, covered with vulcanite; measures 120 x 120mm. The sideward motion is controlled by a worm screw drive, the backward and forward motions by rack and pinion, covering a range of 31 x 51mm respectively. The screw heads are located at the right-hand side and do not obstruct the stage proper. Removing the arms holding the slide converts the stage to a plain surface with complete mechanical motions. Each movement is provided with scales divided in millimeters and verniers facilitate reorientation of specimens. (*For further details, see No. 22613, page 171.*)

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

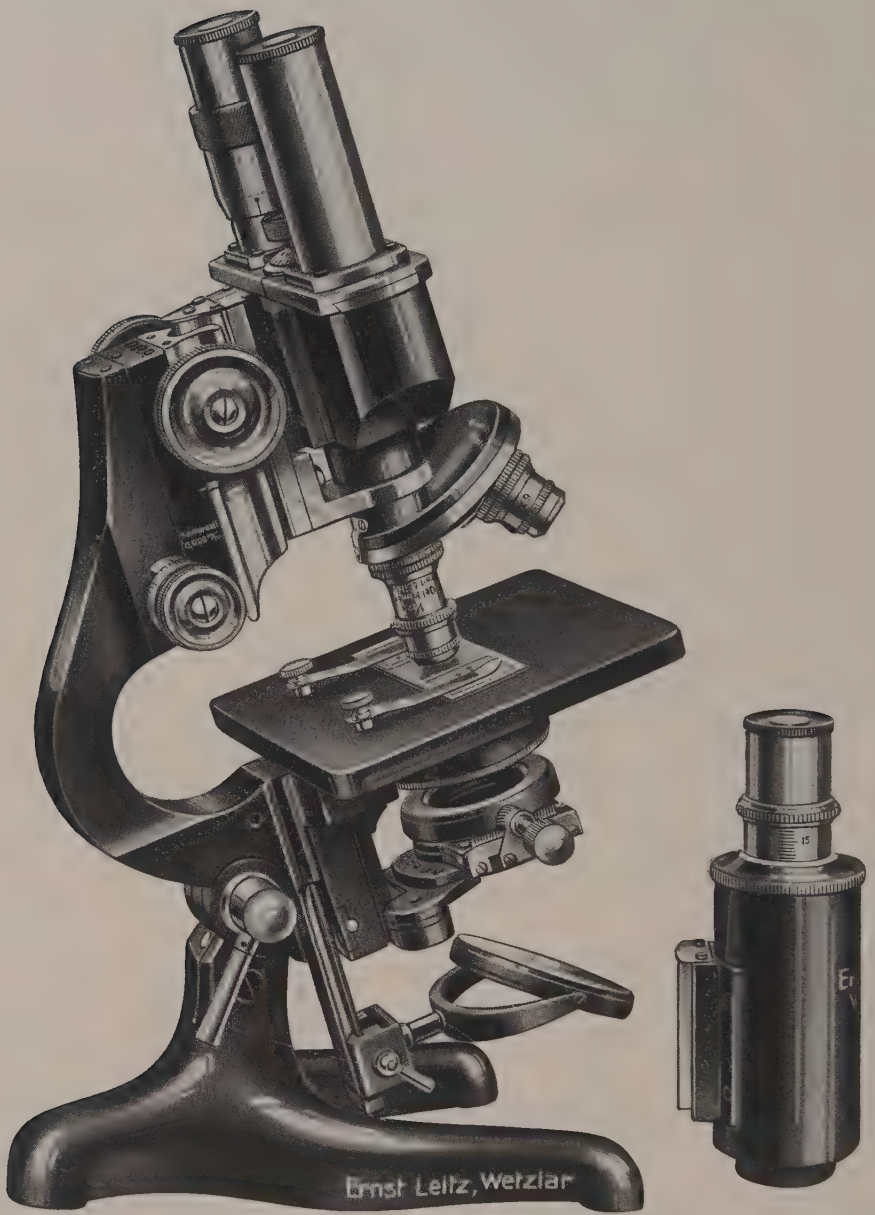
Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AGOBZ	**CBMT-10a**	**Microscope "CBMT",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*).....	$
AGOCH	**CBMT-13**	**Microscope "CBMT",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*).....	
AGODS	**CBMT-22**	**Microscope "CBMT",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*).....	
AGOEV	**CBMT-30a**	**Microscope "CBMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*).....	
AGOFM	**CBMT-35a**	**Microscope "CBMT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)..	
AGOGA	**CBMT-40a**	**Microscope "CBMT",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, **without** objectives or oculars.....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The monocular body tube is regularly included; if not desired, **deduct** $.



COMBINATION MICROSCOPE "CBMS"
for Binocular and Monocular Vision

U. S. Patent Nos. 1,429,557 and 1,448,592

Binocular Body Tube attached,
showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "CBMS"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. **The monocular body tube converts microscope "CBMS" for monocular vision.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.002mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 114 x 114mm; provided with stage clips.

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

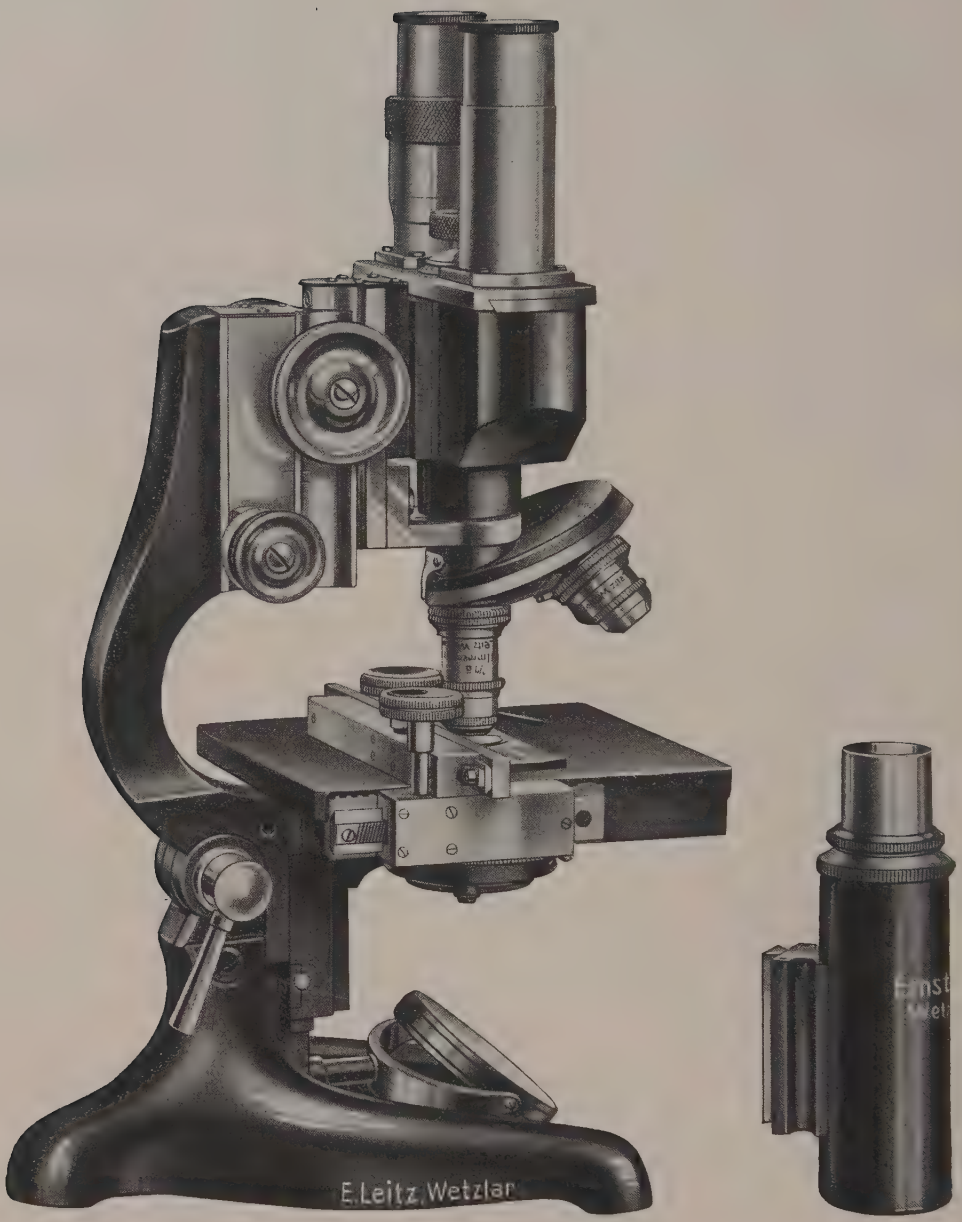
Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AGOHJ	**CBMS-10a**	**Microscope "CBMS",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*)	$
AGOIB	**CBMS-13**	**Microscope "CBMS",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*)	
AGOJN	**CBMS-22**	**Microscope "CBMS",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*)	
AGOKK	**CBMS-30a**	**Microscope "CBMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*)	
AGOLF	**CBMS-35a**	**Microscope "CBMS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)	
AGOMP	**CBMS-40a**	**Microscope "CBMS",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, **without** objectives or oculars	
DECHA	**22622**	**Mechanical Stage, with** millimeter scales and verniers, **in case** (listed on page 172)	
DECCI	**22622a**	**Mechanical Stage, without** millimeter scales or verniers, **in case** (listed on page 172)	

* *These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The monocular body tube is regularly included; if not desired, **deduct** $.



COMBINATION MICROSCOPE "LBMS"
for Binocular and Monocular Vision

U. S. Patent No. 1,448,592

Binocular Body Tube and Simplified Built-On Mechanical Stage attached, showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "LBMS"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. **The monocular body tube converts microscope "LBMS" for monocular vision.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or students' use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square, 114 x 114mm; of brass, covered with vulcanite; built-on to the side of the stage is a complete mechanical stage without scales or verniers, permanently attached to the square stage of the microscope. It has sufficient range of motion to completely cover the standard 25 x 75mm slide. The mechanical motions are at right angles by means of two racks and pinions.

Substage—Simplified rack and pinion substage model "c" (*described on page 24*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

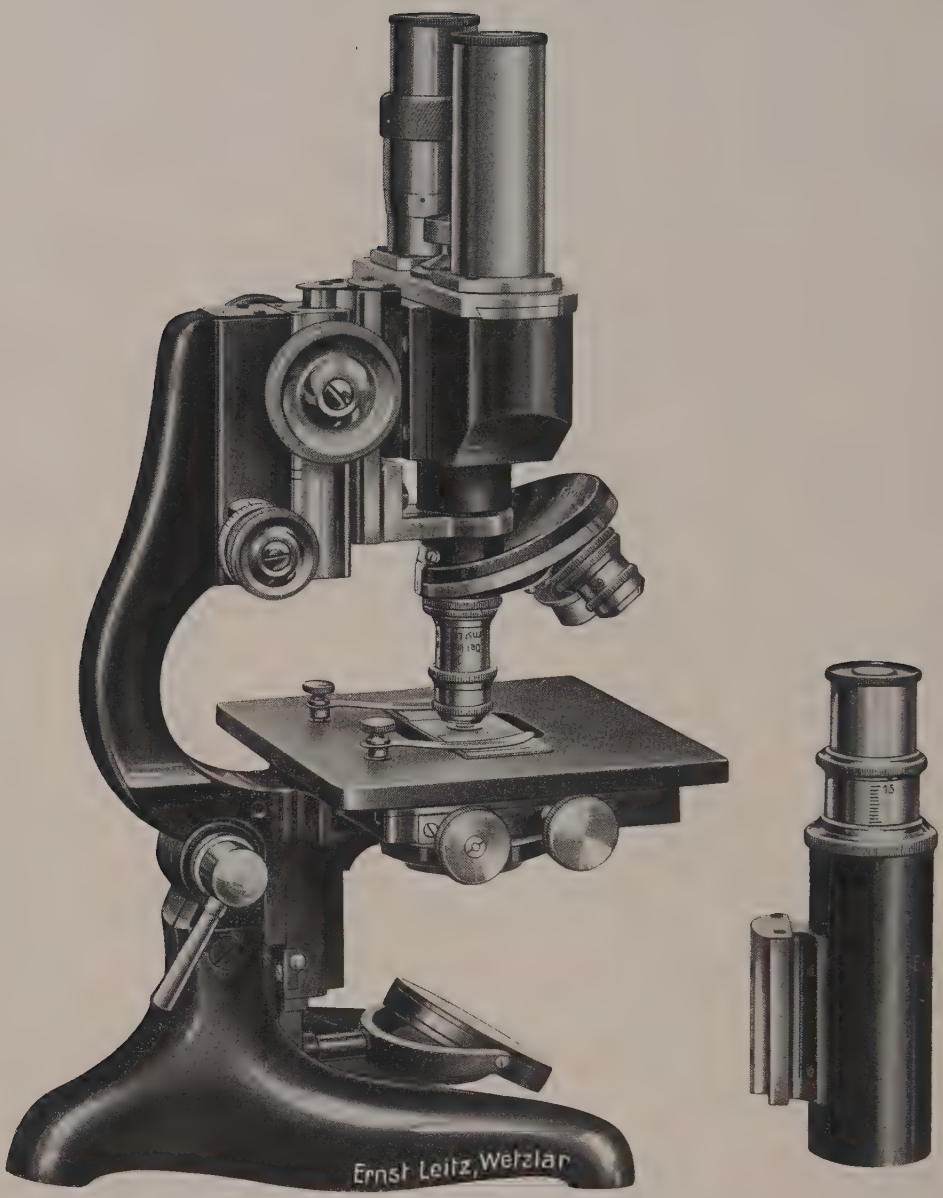
Code Word	Cat. No.	Designation	Price
LABKT	**LBMS-10a**	**Microscope "LBMS",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*).....	$
LABJK	**LBMS-13**	**Microscope "LBMS",** including substage "c" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*).....	
LABUF	**LBMS-15a**	**Microscope "LBMS",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **15a*** (*Magnification: 60-950X*).....	
LABYP	**LBMS-20a**	**Microscope "LBMS",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **20a*** (*Magnification: 60-950X*).....	
LABMJ	**LBMS-22**	**Microscope "LBMS",** including substage "c" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*).....	
LABNL	**LBMS-30a**	**Microscope "LBMS",** including substage "c" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*).....	
AUSTA	**LBM-4**	**Monocular Body Tube,** 35mm (not included in above equipments)	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The above microscope equipments can be supplied **without** cabinet and **without** boxes for objectives, in which case **the following deductions apply:**

Allowance for cabinet.....$
Allowance for each objective box....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)



COMBINATION MICROSCOPE "LBMT"
for Binocular and Monocular Vision

U. S. Patent No. 1,448,592

Binocular Body Tube and Stage with Mechanical Motions attached,
showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "LBMT"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. **The monocular body tube converts microscope "LBMT" for monocular vision.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or students' use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square, 114 x 114mm; completely covered with vulcanite; with mechanical motions at right angles to each other, operated by two buttons on one side, easily accessible. The movement is within a range of 25mm in both directions, to and from the operator, also lateral, sufficient to completely cover a 25mm square coverglass.

Substage—Simplified rack and pinion substage model "c" (*described on page 24*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

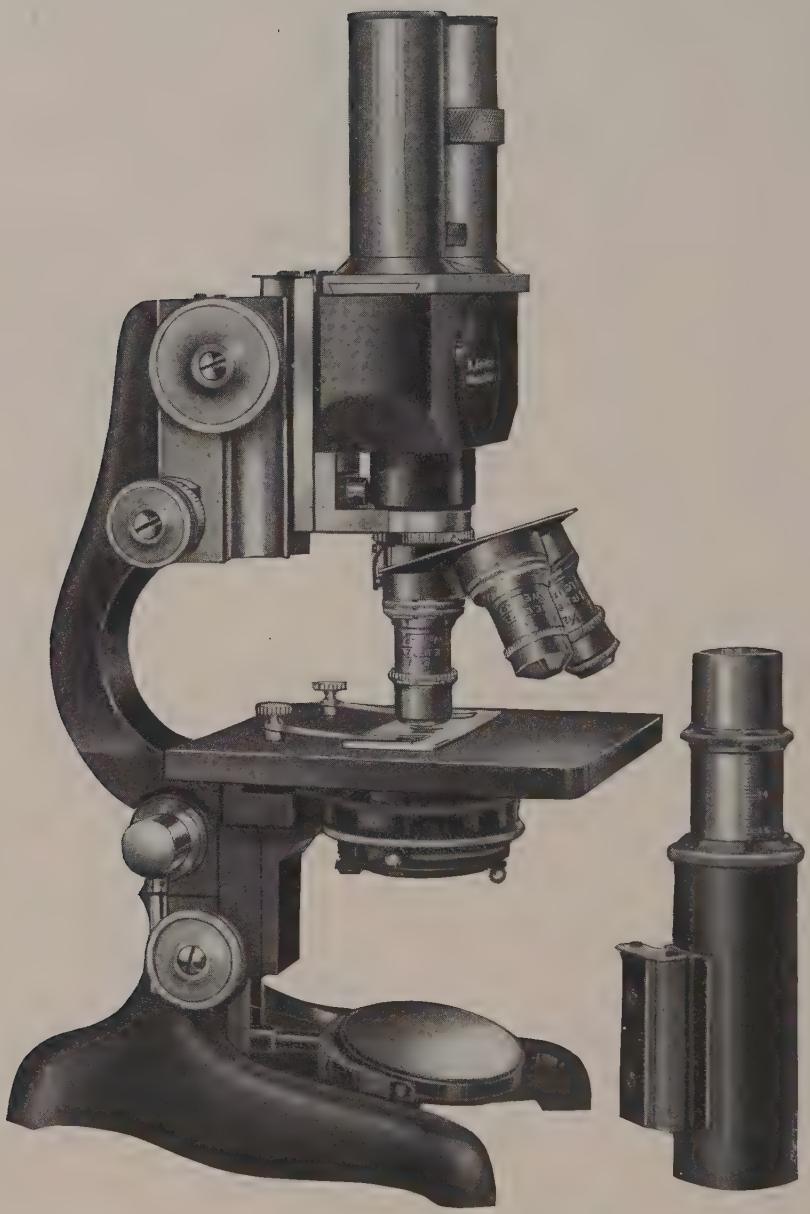
Code Word	Cat. No.	Designation	Price
LABRG	**LBMT-10a**	**Microscope "LBMT",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*).....	$
LABSH	**LBMT-13**	**Microscope "LBMT",** including substage "c" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*).....	
LABTS	**LBMT-15a**	**Microscope "LBMT",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **15a*** (*Magnification: 60-950X*).....	
LABVB	**LBMT-20a**	**Microscope "LBMT",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **20a*** (*Magnification: 60-950X*).....	
LABWQ	**LBMT-22**	**Microscope "LBMT",** including substage "c" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*).....	
LABXW	**LBMT-30a**	**Microscope "LBMT",** including substage "c" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*).....	
AUSTA	**LBM-4**	**Monocular Body Tube,** 35mm (not included in above equipments)	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The above microscope equipments can be supplied **without** cabinet and **without** boxes for objectives, in which case **the following deductions apply:**

Allowance for cabinet.....$
Allowance for each objective box....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)



COMBINATION MICROSCOPE "LBM"
for Binocular and Monocular Vision

U. S. Patent No. 1,448,592

Binocular Body Tube attached,
showing Monocular Body Tube detached

"MON-OBJECTIVE" BINOCULAR MICROSCOPE "LBM"

Binocular Body Tube—Consists of a housing containing a prism system, the casing being provided with two parallel ocular tubes for the accommodation of paired oculars. These tubes are fitted to a slider permitting adjustment to interpupillary distance and reading this distance off a millimeter scale. One ocular tube is supplied with a spiral screw to correct against difference of vision between the eyes of the observer. The binocular body tube is fastened to the microscope stand by sliding it into the rack and pinion track and locking it securely in place by means of a lever with eccentric bearing; a slight touch suffices to exert a locking grip. (*U. S. Patent No. 1,448,592.*)

Monocular Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard size oculars; the draw tube being graduated in single millimeters, every tenth line numbered. **The monocular body tube converts microscope "LBM" for monocular vision.** This tube attaches in an identical manner as explained with the binocular body tube.

Nosepiece Adapter—Attaches to the rack and pinion track of the microscope and in carrying the nosepiece independent from the body tubes **maintains the objectives permanently centered,** regardless of which tube is used.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or students' use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 114 x 114mm; provided with stage clips.

Substage—Simplified rack and pinion substage model "c" (*described on page 24*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

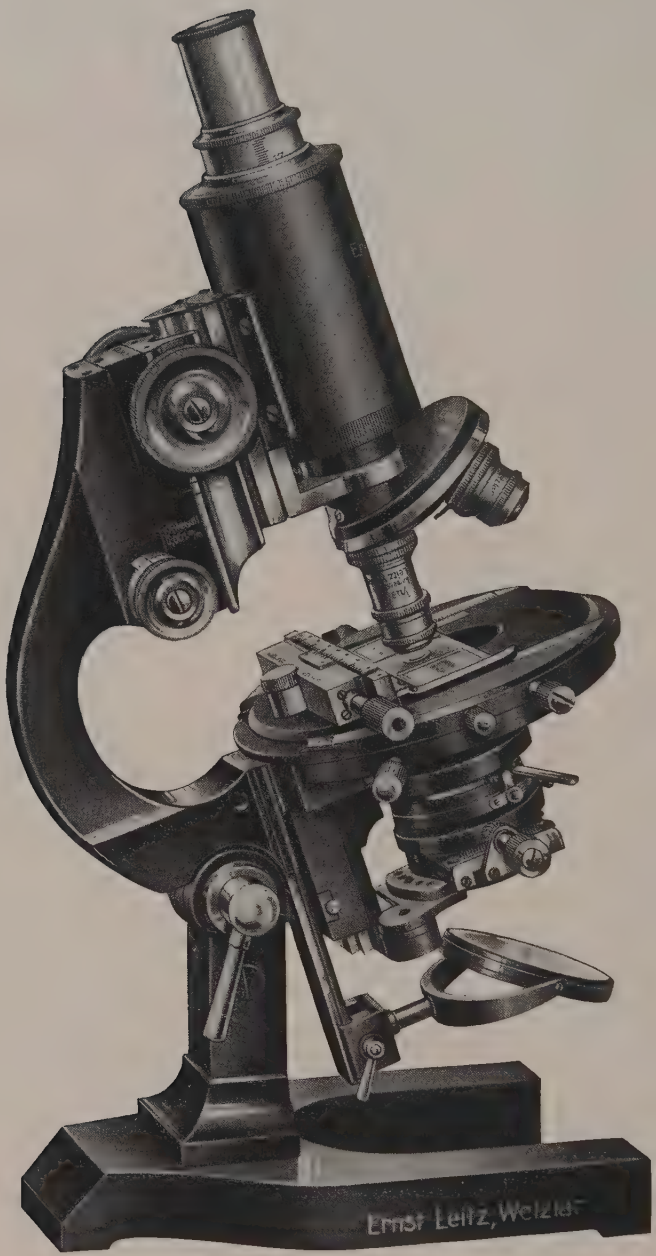
Code Word	Cat. No.	Designation	Price
ALBTN	**LBM-10a**	**Microscope "LBM",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*).....	$
AGONC	**LBM-13**	**Microscope "LBM",** including substage "c" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*).....	
ALBFT	**LBM-15a**	**Microscope "LBM",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **15a*** (*Magnification: 60-950X*).....	
ALBWY	**LBM-20a**	**Microscope "LBM",** including substage "c" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **20a*** (*Magnification: 60-950X*).....	
AGOOG	**LBM-22**	**Microscope "LBM",** including substage "c" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*).....	
AGOPL	**LBM-30a**	**Microscope "LBM",** including substage "c" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*).....	
AUSTA	**LBM-4**	**Monocular Body Tube,** 35mm (not included in above equipments)	
DECHA	**22622**	**Mechanical Stage, with** millimeter scales and verniers, **in case** (*listed on page 172*).....	
DECCI	**22622a**	**Mechanical Stage, without** millimeter scales or verniers, **in case** (*listed on page 172*)..... **Note:** *If mechanical stages are ordered* ***without cases, deduct and add "NOCAS"*** *to code word.*	

* *These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: The above microscope equipments can be supplied **without** cabinet and **without boxes** for objectives, in which case **the following deductions apply:**

Allowance for cabinet.....$
Allowance for each objective box....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)



MICROSCOPE "AA"
for Research and Photo-Micrography

U. S. Patent No. 1,429,557

Rotary Mechanical Stage No. 22611 attached

MICROSCOPE "AA"

Body Tube—Outside diameter 50mm. It is provided with draw tube tubulation for standard size oculars, the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as draw tube are detachable for use with wide angle objectives; i. e., "Micro Summars."

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—125mm diameter; circular pattern, provided with centering screws, revolvable, with clamping device to arrest rotation when desired; mechanical movement by rack and pinion in two directions, scales divided in millimeters and verniers facilitate reorientation of specimen; slides 50 x 75mm may be examined from corner to corner. It is designed so that oil does not come in contact with the stage when immersion contact between condenser and slide is established. The mechanical motion device is removable, leaving large plain surface with one rack movement for use with large specimens. (*For further details, see No. 22611, page 169.*)

Substage—Model "b" (*described on page 23*).

Base, Pillar and Arm—The **base** is of extra large horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

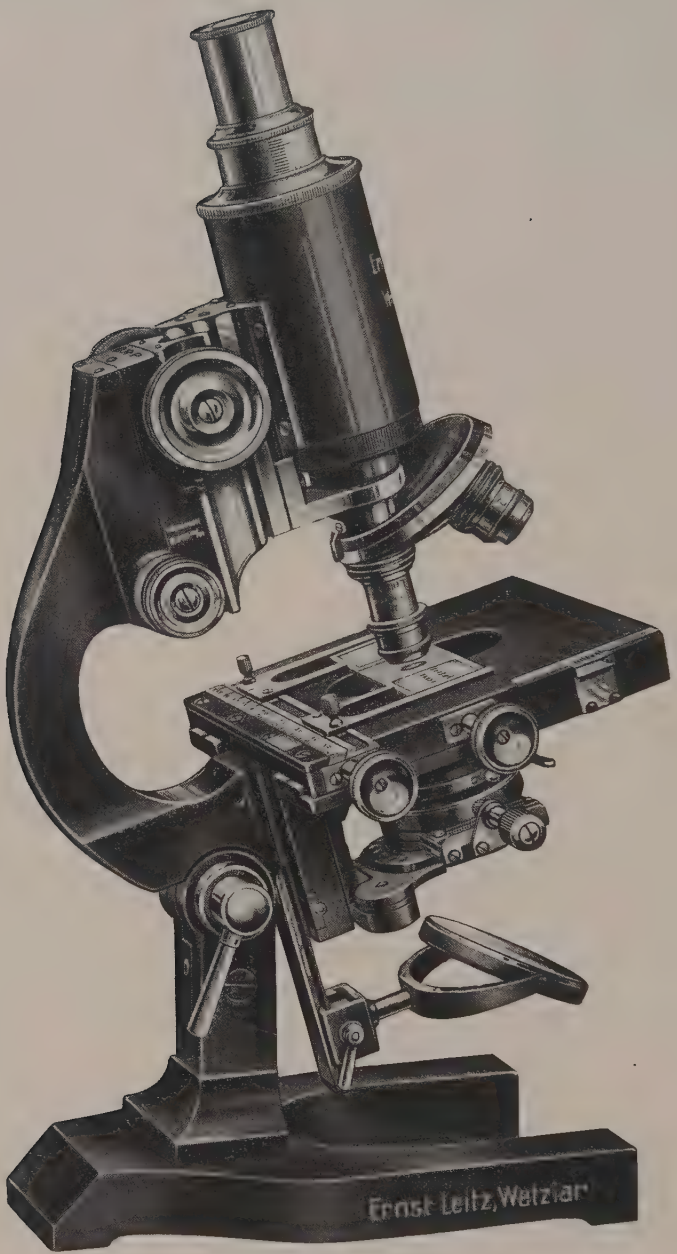
Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AGOQY	**AA-13**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*)...	$
AGORX	**AA-22**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*)...	
AGOST	**AA-30a**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*)..	
AGOTU	**AA-35a**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)..	
AGOUR	**AA-37**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16-1840X*)..	
AGOVO	**AA-39**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16-2280X*)..	
AGOWD	**AA-40a**	**Microscope "AA",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	
ABMVX	**22842**	**Binocular Body Tube,** which permits stand "AA" to be converted into a combination microscope for binocular and monocular vision (*both binocular and monocular tubes can be readily interchanged; **paired oculars are required for the binocular tube** and these should be ordered with this body*).....	
ABBLI	**22846**	**Monocular Body Tube with Side Telescope,** for photo-micrography, permitting constant observation of image when microscope is connected with camera (*interchangeable against monocular and binocular tubes*).....	

* *These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

Note: If microscope "AA" is desired with revolving **plain** stage in place of mechanical stage, **deduct $.**



MICROSCOPE "AT"
for Research and Photo-Micrography

U. S. Patent No. 1,429,557

Mechanical Stage No. 22613 attached

MICROSCOPE "AT"

Body Tube—Outside diameter 50mm. It is provided with draw tube tubulation for standard size oculars, the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as draw tube are detachable for use with wide angle objectives; i. e., "Micro Summars."

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*); a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square pattern, *combined mechanical and plain*, of metal, covered with vulcanite; measures 120 x 120mm. The sideward motion is controlled by a worm screw drive, the backward and forward motion by rack and pinion, covering a range of 31 x 51mm respectively. The screw heads are located at the right-hand side and do not obstruct the stage proper. Removing the arms holding the slide converts the stage to a plain surface with complete mechanical motions. Each movement is provided with scales divided in millimeters and verniers facilitate reorientation of specimens. (*For further details, see No. 22613, page 171.*)

Substage—Model "b" (*described on page 23*).

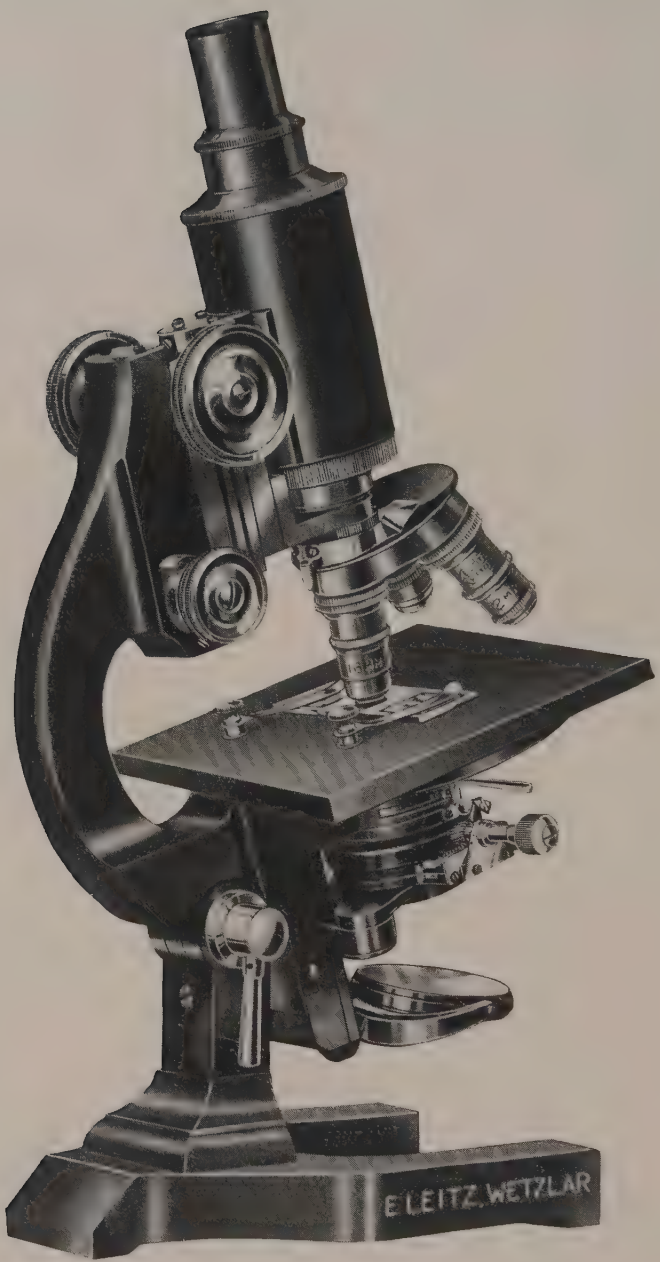
Base, Pillar and Arm—The **base** is of extra large horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AGOXI	**AT-13**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600 X*)..	$
AGOYW	**AT-22**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520 X*)...	
AGOZE	**AT-30a**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380 X*)..	
AKEHJ	**AT-35a**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840 X*)..	
AKEIB	**AT-37**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16-1840 X*)...	
AKEJN	**AT-39**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16-2280 X*)...	
AKEKK	**AT-40a**	**Microscope "AT",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	
ABMVX	**22842**	**Binocular Body Tube,** which permits stand "AT" to be converted into a combination microscope for binocular and monocular vision (*both binocular and monocular tubes can be readily interchanged; **paired oculars are required for the binocular tube** and these should be ordered with this body*).....	
ABBLI	**22846**	**Monocular Body Tube with Side Telescope,** for photo-micrography, permitting constant observation of image when microscope is connected with camera (*interchangeable against monocular and binocular tubes*).....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*



MICROSCOPE "AS"
for Research and Photo-Micrography

U. S. Patent No. 1,429,557

MICROSCOPE "AS"

Body Tube—Outside diameter 50mm. It is provided with draw tube tubulation for standard size oculars, the draw tube being graduated in single millimeters, every tenth line numbered. The lower collar as well as draw tube are detachable for use with wide angle objectives; i. e., "Micro Summars."

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*), a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.001mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 125 x 125mm; provided with stage clips.

Substage—Model "b" (*described on page 23*).

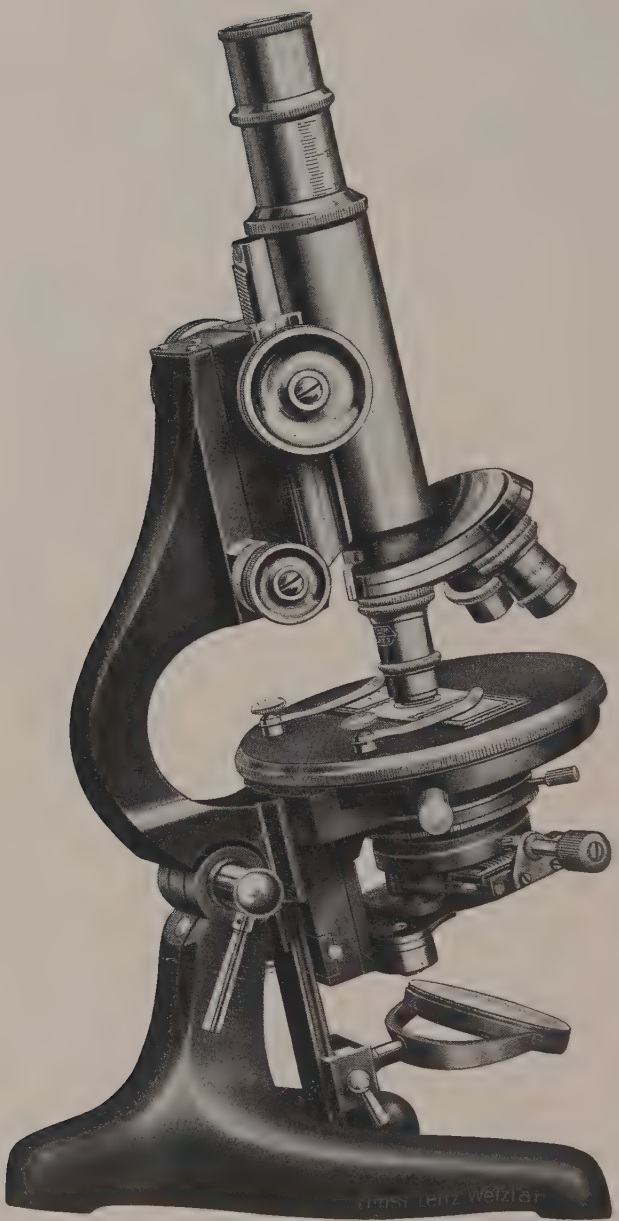
Base, Pillar and Arm—The **base** is of extra large horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AKELF	**AS-13**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600 X*)...	$
AKEMP	**AS-22**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520 X*)...	
AKENC	**AS-30a**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380 X*)..	
AKEOG	**AS-35a**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840 X*)..	
AKEPL	**AS-37**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **37*** (*Magnification: 16-1840 X*).	
AKEQY	**AS-39**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **39*** (*Magnification: 16-2280 X*)...	
AKERX	**AS-40a**	**Microscope "AS",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, **without** objectives or oculars.....	
ABMVX	**22842**	**Binocular Body Tube,** which permits stand "AS" to be converted into a combination microscope for binocular and monocular vision (*both binocular and monocular tubes can be readily interchanged; **paired oculars are required for the binocular tube** and these should be ordered with this body*).....	
ABBLI	**22846**	**Monocular Body Tube with Side Telescope,** for photo-micrography, permitting constant observation of image when microscope is connected with camera (*interchangeable against monocular and binocular tubes*).....	
ABMSU	**22612**	**Mechanical Stage,** regular type, large pattern, permitting objects in size 50x100mm, for microscope "AS" (*listed on page 171*)....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*



MICROSCOPE "C"

Medium-Sized Research Microscope

U. S. Patent No. 1,429,557

MICROSCOPE "C"

Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard oculars, the draw tube being graduated in single millimeters, every tenth line numbered.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*), a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.002mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Revolving plain circular, measures 112mm diameter; made of metal, covered with vulcanite; provided with centering screws.

Substage—Model "b" (*described on page 23*).

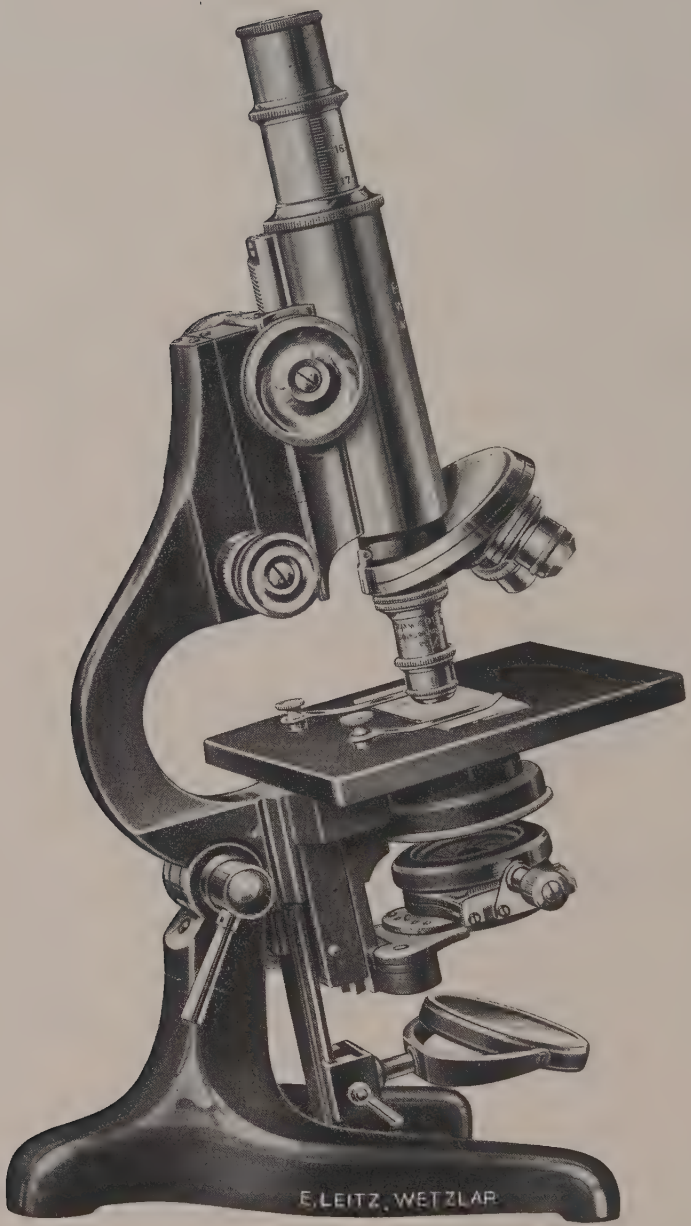
Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AKEST	**C-10a**	**Microscope "C",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000X*).....	$
AKETU	**C-13**	**Microscope "C",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600X*).....	
AKEUR	**C-22**	**Microscope "C",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520X*).....	
AKEVO	**C-30a**	**Microscope "C",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380X*).....	
AKEWD	**C-35a**	**Microscope "C",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840X*)..	
AKEXI	**C-40a**	**Microscope "C",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, **without** objectives or oculars.....	
DECSV	**22614**	**Mechanical Stage,** regular type, large pattern, worm screw drive, for microscope "C" (*listed on page 171*).....	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*



MICROSCOPE "D"

Medium-Sized Research Microscope

U. S. Patent No. 1,429,557

MICROSCOPE "D"

Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard oculars, the draw tube being graduated in single millimeters, every tenth line numbered.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The new ball-bearing micrometer screw (*U. S. Patent No. 1,429,557*) serves as fine adjustment (*for detailed description, see page 33*), a safety device being provided to prevent injury to specimens and objectives. A divided micrometer head with vernier records the lateral displacement of the microscope tube within 0.002mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 114 x 114mm; provided with stage clips.

Substage—Model "b" (*described on page 23*).

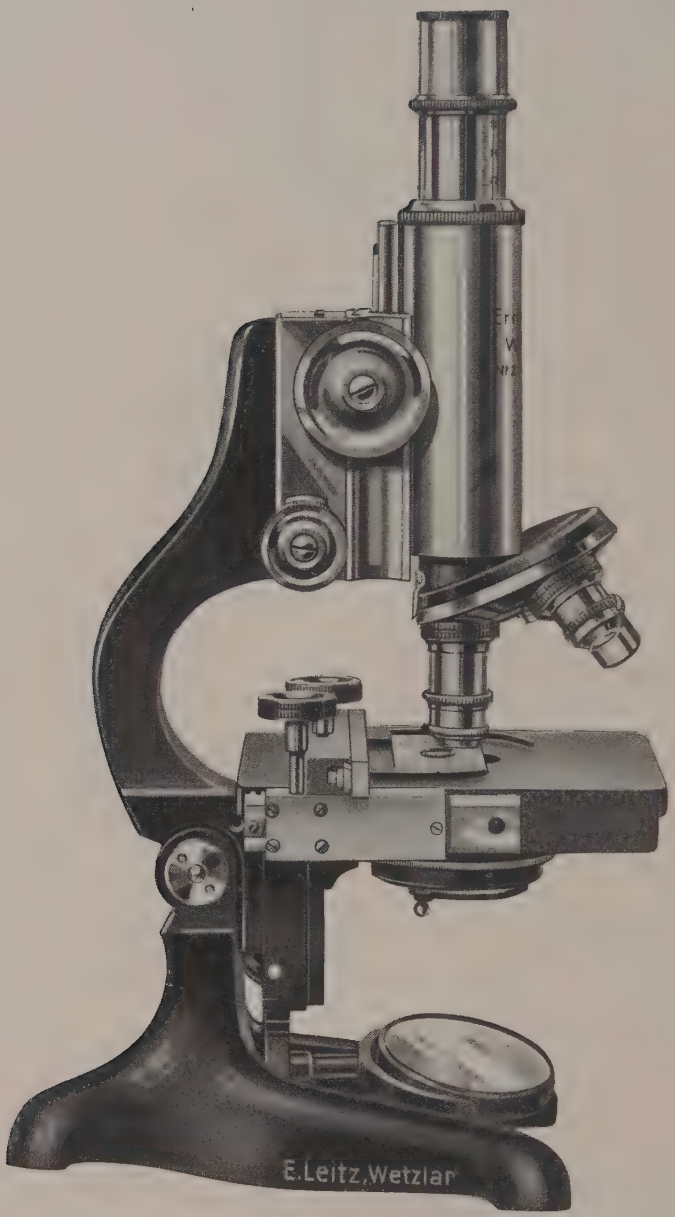
Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and clamping lever to hold the stand in any desired angle, while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Mahogany wood, highly polished, with lock and key.

Code Word	Cat. No.	Designation	Price
AKEYW	**D-10a**	**Microscope "D",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000 X*)	$
AKEZE	**D-13**	**Microscope "D",** including substage "b", with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **13*** (*Magnification: 16-1600 X*)	
AKEAQ	**D-22**	**Microscope "D",** including substage "b" with **two-lens** condenser N.A. 1.20; **quadruple** dustproof nosepiece, optical equipment No. **22*** (*Magnification: 16-1520 X*)	
AKEBZ	**D-30a**	**Microscope "D",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **triple** dustproof nosepiece, optical equipment No. **30a*** (*Magnification: 95-1380 X*)	
AKECH	**D-35a**	**Microscope "D",** including substage "b" with **aplanatic-achromatic** condenser N.A. 1.40; **quadruple** dustproof nosepiece, optical equipment No. **35a*** (*Magnification: 70-1840 X*)	
AKEDS	**D-40a**	**Microscope "D",** including substage "b" with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, **without** objectives or oculars	
DECHA	**22622**	**Mechanical Stage, with** millimeter scales and verniers, **in case** (*listed on page 172*)	
DECCI	**22622a**	**Mechanical Stage, without** millimeter scales or verniers, **in case** (*listed on page 172*)	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*



MICROSCOPE "LS"

Routine Laboratory and Student Microscope

Simplified Built-On Mechanical Stage attached

MICROSCOPE "LS"

Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard oculars, the draw tube being graduated in single millimeters, every tenth line numbered.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or student's use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square, 114 x 114mm; of brass, covered with vulcanite; built-on to the side of the stage is a complete mechanical stage without scales and verniers, permanently attached to the square stage of the microscope. It has sufficient range of motion to completely cover the standard 25 x 75mm slide. The mechanical motions are at right angles by means of two racks and pinions.

Substage—Simplified rack and pinion substage model "c" (*described on page 24*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and friction device to hold stand at any desired angle while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

Code Word	Cat. No.	Objectives		Huyghenian Oculars	Combined Magn.	Nosepiece	Two-lens Condenser	Price
		Dry	Oil Immersion					
		Achromatic						$
LABAR	**LS-6**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Double	N.A. 1.20	
LABBY	**LS-8**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Triple	N.A. 1.20	
LABCO	**LS-9a**	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**None**	6X-10X	26-450X	Triple	N.A. 1.20	
LABDI	**LS-10**	**10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30	6X-10X	60-1000X	Triple	N.A. 1.20	
		Achromatic and Fluorite						
LABEX	**LS-15**	**10X** (16mm) **45X**† (4mm)	**95X*** (1.95mm) N.A. 1.32	6X-10X	60-950X	Triple	N.A. 1.20	
LABFA	**LS-20**	**10X** (16mm) **42X*** (4.2mm)	**95X*** (1.95mm) N.A. 1.32	6X-10X	60-950X	Triple	N.A. 1.20	

* Objectives of Fluorite (Semi-Apochromatic) type.

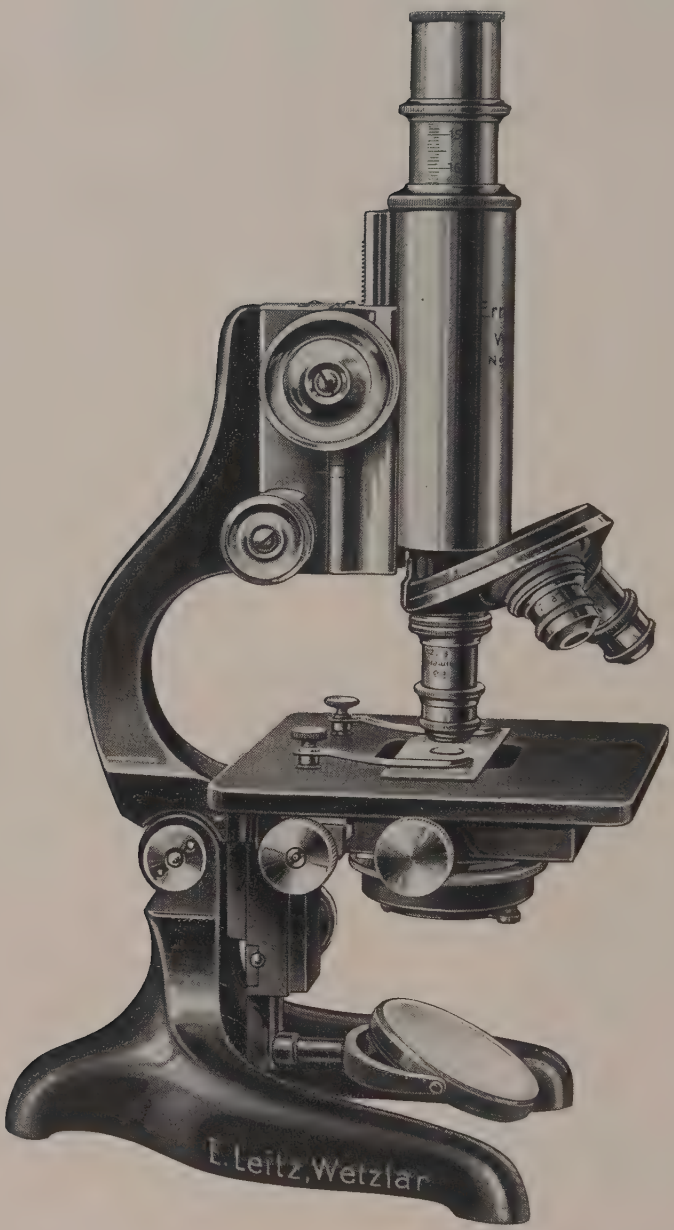
† With long working distance.

Note: The above microscope equipments can be supplied **without** cabinet and **without** boxes for objectives, in which case **the following deductions apply:**

Allowance for cabinet .....$

Allowance for each objective box....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)



MICROSCOPE "LT"

Routine Laboratory Microscope

Stage with Mechanical Motions attached

MICROSCOPE "LT"

Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard oculars, the draw tube being graduated in single millimeters, every tenth line numbered.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or student's use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Square, 114 x 114mm; completely covered with vulcanite; with mechanical motions at right angles to each other, operated by two buttons on one side, easily accessible. The movement is within a range of 25mm in both directions, to and from the operator, also lateral, sufficient to completely cover a 25mm square coverglass.

Substage—Simplified rack and pinion substage model "e" (*described on page 24*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and friction device to hold stand at any desired angle while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

Code Word	Cat. No.	Objectives		Huygenian Oculars	Combined Magn.	Nosepiece	Two-lens Condenser	Price
		Dry	Oil Immersion					
		Achromatic						$
LABZV	**LT-6**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Double	N.A. 1.20	
LEDAQ	**LT-8**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Triple	N.A. 1.20	
LEDBZ	**LT-9a**	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**None**	6X-10X	26-450X	Triple	N.A. 1.20	
LEDCH	**LT-10**	**10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30	6X-10X	60-1000X	Triple	N.A. 1.20	
		Achromatic and Fluorite						
LEDDS	**LT-15**	**10X** (16mm) **45X**† (4mm)	**95X*** (1.95mm) N.A. 1.32	6X-10X	60-950X	Triple	N.A. 1.20	
LEDEV	**LT-20**	**10X** (16mm) **42X*** (4.2mm)	**95X*** (1.95mm) N.A. 1.32	6X-10X	60-950X	Triple	N.A. 1.20	

* Objectives of Fluorite (Semi-Apochromatic) type.

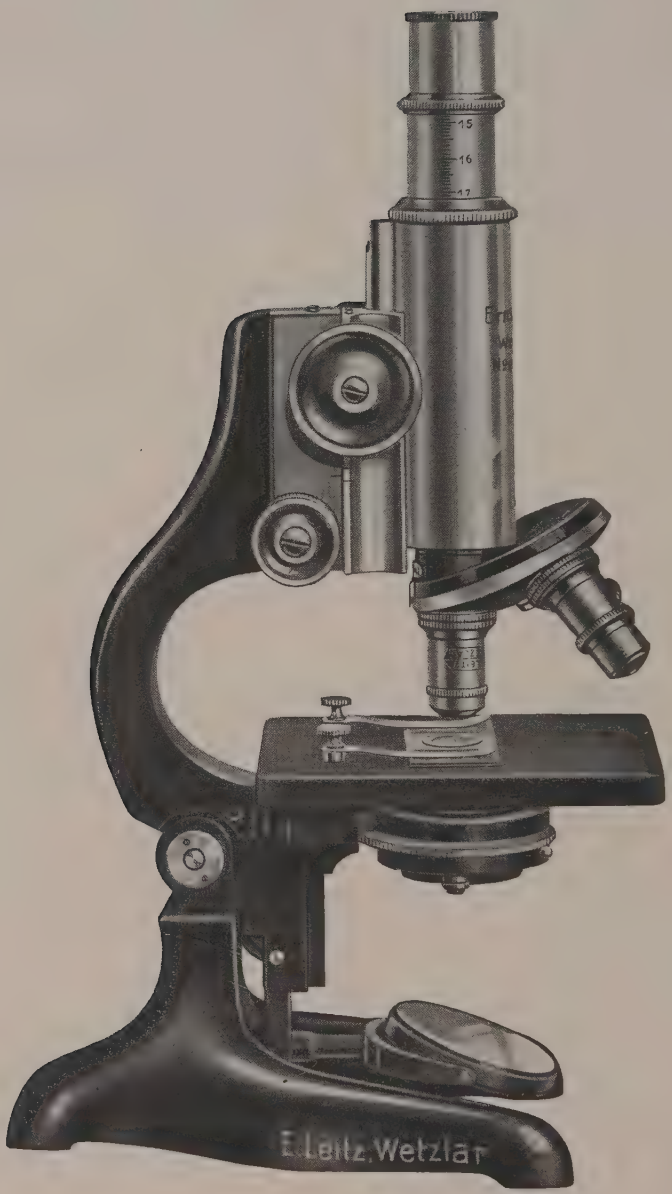
† With long working distance.

Note: The above microscope equipments can be supplied **without** cabinet and **without** boxes for objectives, in which case **the following deductions apply:**

Allowance for cabinet .....$

Allowance for each objective box....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)



MICROSCOPE "L"
Routine Laboratory and Student Microscope

MICROSCOPE "L"

Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard oculars, the draw tube being graduated in single millimeters, every tenth line numbered.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or student's use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 114 x 114mm; provided with stage clips.

Substage—Simplified rack and pinion substage model "c" (*described on page 24*).

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and friction device to hold stand at any desired angle while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

Code Word	Cat. No.	Objectives		Huygenian Oculars	Combined Magn.	Nosepiece	Two-lens Condenser	Price
		Dry	Oil Immersion					
		Achromatic						$
ABDLC	**L-6**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Double	N.A. 1.20	
ABDNI	**L-8**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Triple	N.A. 1.20	
ABDTF	**L-9a**	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**None**	6X-10X	26-450X	Triple	N.A. 1.20	
ABDVS	**L-10**	**10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30	6X-10X	60-1000X	Triple	N.A. 1.20	
		Achromatic and Fluorite						
ABDZL	**L-15**	**10X** (16mm) **45X**† (4mm)	**95X*** (1.95mm) N.A. 1.32	6X-10X	60-950X	Triple	N.A. 1.20	
ABIBO	**L-20**	**10X** (16mm) **42X*** (4.2mm)	**95X*** (1.95mm) N.A. 1.32	6X-10X	60-950X	Triple	N.A. 1.20	
DECHA	**22622**	**Mechanical Stage, with** millimeter scales and verniers, **in case** (*listed on page 172*)						
DECCI	**22622a**	**Mechanical Stage, without** millimeter scales or verniers, **in case** (*listed on page 172*)						
		Note: *If mechanical stages are ordered* ***without cases, deduct*** ..... *and* ***add "NOCAS"*** *to code word.*						

* Objectives of Fluorite (Semi-Apochromatic) type.

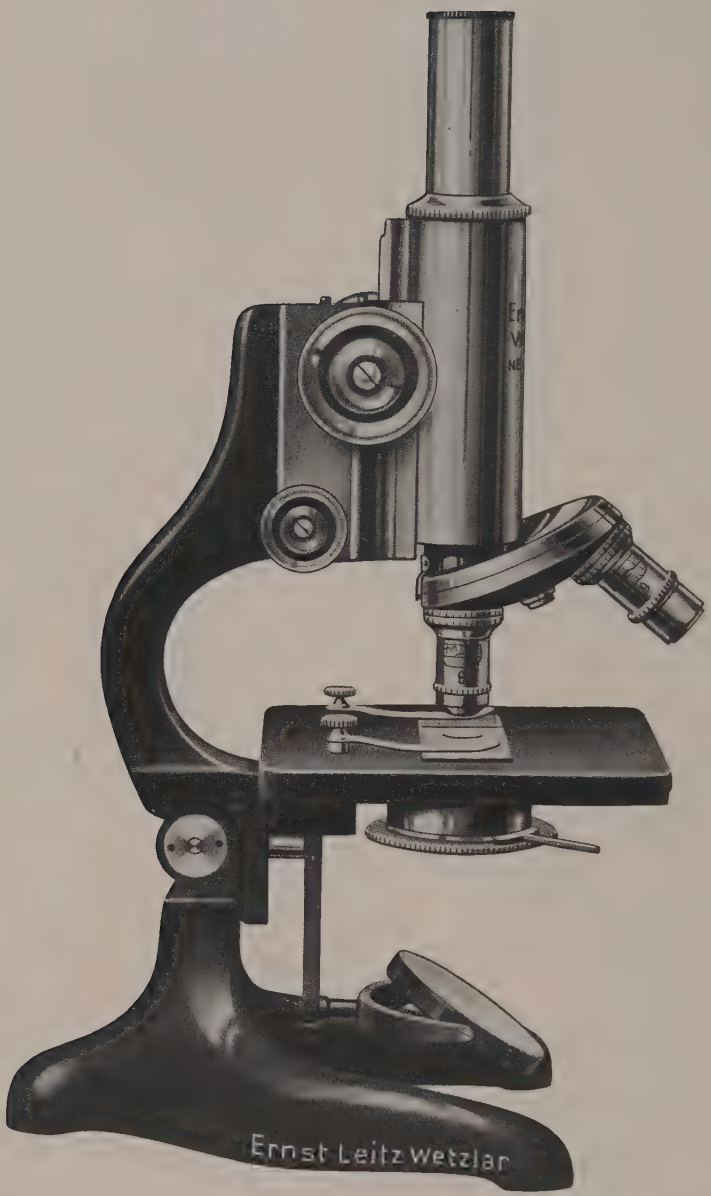
† With long working distance.

Note: The above microscope equipments can be supplied **without** cabinet and **without** boxes for objectives, **in which case the following deductions apply:**

Allowance for cabinet .....$

Allowance for each objective box....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)



MICROSCOPE "LL"

College Microscope

MICROSCOPE "LL"

Body Tube—Is of 35mm diameter; stationary pattern (*if desired, adjustable draw tube will be furnished without charge*).

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes in routine laboratory work or student's use are naturally subjected; a safety device being provided to prevent injury to specimens and objectives. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 114 x 114mm; provided with stage clips. The sleeve beneath the stage carries a cylinder iris diaphragm situated in the plane of the stage.

Substage—In withdrawing the cylinder iris diaphragm, the stage sleeve is available for the adaptation of substage condensers. (*The equipments listed below include condenser wherever mentioned.*)

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and friction device to hold stand at any desired angle while stops are provided for horizontal and vertical positions. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

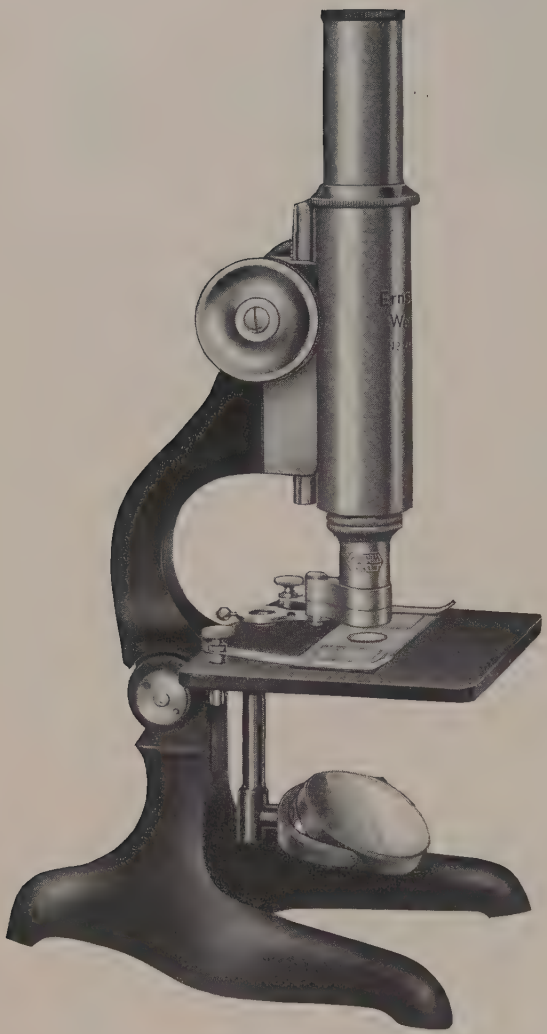
Cabinet—Hardwood, highly polished, with lock and key.

Code Word	Cat. No.	Objectives		Huy-ghenian Oculars	Com-bined Magn.	Nose-piece	Two-lens Con-denser	Price
		Dry	Oil Immersion					
AKEEV	**LL-0a**	**Double divisible** No. 22005a*	**None**	12X	70-140X	None	None	$
AKEFM	**LL-0b**	**Double divisible** No. 22005a*	**None**	6X-12X	36-140X	None	None	
ABCCZ	**LL-1a**	**Triple divisible** No. 22006a*	**None**	12X	100-500X	None	None	
ABCDI	**LL-1b**	**Triple divisible** No. 22006a*	**None**	6X-12X	50-500X	None	None	
ABANY	**LL-2a**	**10X** (16mm) **45X**† (4mm)	**None**	10X	100-450X	Double	None	
ABIFI	**LL-4**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Double	None	
ABIHK	**LL-6**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Double	N.A. 1.20	
ABIMP	**LL-7a**	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**None**	6X-10X	26-450X	Triple	None	
ABITX	**LL-9a**	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**None**	6X-10X	26-450X	Triple	N.A. 1.20	
ACEAL	**LL-10**	**10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30	6X-10X	60-1000X	Triple	N.A. 1.20	
DECHA	**22622**	**Mechanical Stage, with** millimeter scales and verniers, **in case** (*listed on page 172*)						
DECCI	**22622a**	**Mechanical Stage, without** millimeter scales or verniers, **in case** (*listed on page 172*)						
		Note: *If mechanical stages are ordered* ***without cases, deduct*** *.....* *and* ***add "NOCAS"*** *to code word.*						

* The divisible objectives are listed on page 18.
† With long working distance.

Note: The above microscope equipments can be supplied **without** cabinet and **without** boxes for objectives, in which case **the following deductions apply:**
Allowance for cabinet .....$
Allowance for each objective box....$
(*When ordering as above,* **add "NOCAB"** *to code word.*)

MICROSCOPE "O"



Microscope "O"
Desirable for Elementary Schools

This model is of simple construction; however, it retains all the features of a compound microscope. It is fully sufficient for routine work in elementary biological laboratories where a magnification exceeding 500X is not required. In construction it dispenses with complicated parts and is not equipped with a micrometer fine adjustment. The rack and pinion is very accurate and serves smooth as well as quick focusing. Standard *"Huyghenian"* oculars are utilized.

Body Tube—Is of 30mm diameter; stationary pattern.

Focusing Adjustment—Consists of diagonal rack and pinion. (*Not recommended for objectives of shorter focal length than 4mm.*)

Stage—100 x 90mm, providing a distance of 63mm from center to arm at stage surface; furnished with stage clips.

Substage—Rotating disc diaphragm with multiple circular openings provides for varying the intensity of illumination. Plano-concave mirror, 40mm diameter, is mounted to an adjustable bracket.

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** has a double joint and friction device to hold stand at any desired angle. The **arm** is of heavy curved form providing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with lock and key.

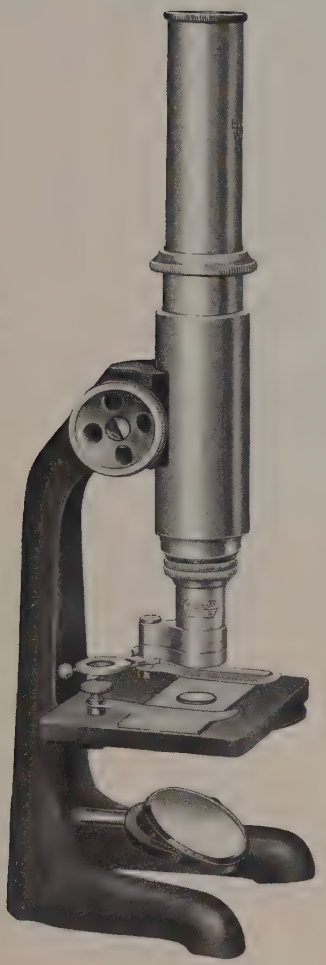
Code Word	Cat. No.	Objectives		Huyghenian Oculars	Combined Magn.	Price
		Dry	Oil Immersion			
ATNSW	**O-X**	**Double divisible** No. 22005a*	**None**	12X	70-140X	$
ABAEQ	**O-Xa**	**Double divisible** No. 22005a*	**None**	6X-12X	36-140X	
ABAIM	**O-1**	**Triple divisible** No. 22006a*	**None**	12X	100-500X	
ABAMU	**O-1a**	**Triple divisible** No. 22006a*	**None**	6X-12X	50-500X	

* The divisible objectives are listed on page 18.

Note: The above microscope equipments can be supplied **without** cabinet, in which case, **the following deduction applies:**
Allowance for cabinet .....$

(*When ordering as above,* **add "NOCAB"** *to code word.*)

MICROSCOPE "P"



Microscope "P"
Desirable for Elementary Schools

Like the preceding type "O," the microscope "P" is of simple construction; however, it retains all the features of a compound microscope. It differs from model "O" in not being provided with an inclination joint; it is, however, sufficient for routine work in elementary biological laboratories where a magnification exceeding 500X is not required. In construction it dispenses with complicated parts and is not equipped with a micrometer fine adjustment. The rack and pinion is very accurate and serves smooth as well as quick focusing. Standard *"Huyghenian"* oculars are utilized.

Body Tube—Is of 30mm diameter, stationary pattern; the inner tube with objective and ocular glides within the body tube, the rack and pinion raising and lowering the inner tube for focusing.

Focusing Adjustment—Consists of diagonal rack and pinion. (*Not recommended for objectives of shorter focal length than 4mm.*)

Stage—77 x 66mm, furnished with stage clips.

Substage—Rotating disc diaphragm with multiple circular openings provides for varying the intensity of illumination. Plano-concave mirror, 35mm diameter, is mounted to an adjustable bracket.

Base, Pillar and Arm—The **base** is of modified horseshoe form. The **pillar** does not provide for inclination joint. The **arm** is of heavy construction and rounded contour.

Finish—In alcohol-proof lacquer throughout.

Cabinet—Hardwood, highly polished, with catch.

Code Word	Cat. No.	Objectives		Huyghenian Oculars	Combined Magn.	Price
		Dry	Oil Immersion			
ADFDY	**P-X**	**Double divisible** No. 22005a*	**None**	12X	70-140X	$
ADFFX	**P-Xa**	**Double divisible** No. 22005a*	**None**	6X-12X	36-140X	
ADFUB	**P-1**	**Triple divisible** No. 22006a*	**None**	12X	100-500X	
ADFUZ	**P-1a**	**Triple divisible** No. 22006a*	**None**	6X-12X	50-500X	

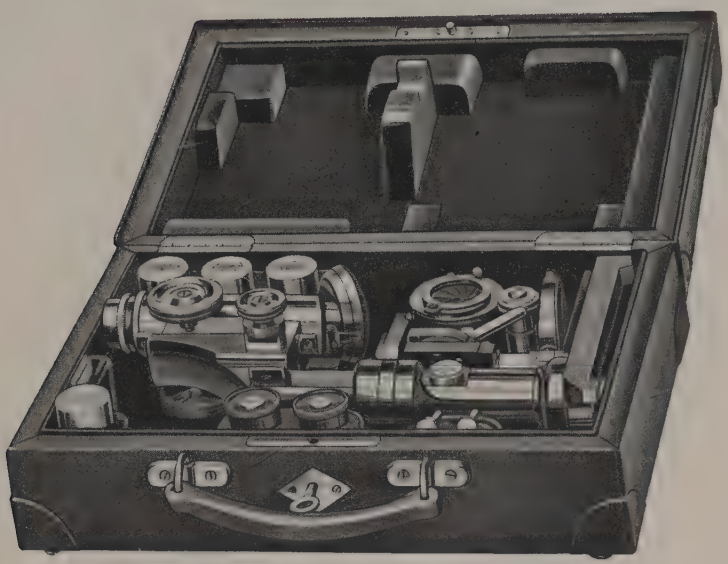
* The divisible objectives are listed on page 18.

Note: The above microscope equipments can be supplied **without** cabinet, in which case, **the following deduction applies:**
Allowance for cabinet .....$
(*When ordering as above,* **add "NOCAB"** *to code word.*)

Pages 81 to 97 cover

SPECIAL MICROSCOPE MODELS

LARGE TRAVELLING MICROSCOPE "DT"



(Folded in leather case, 29½ x 21 x 10½cm)

Body Tube—Is of 35mm diameter. It is provided with draw tube tubulation for standard oculars, the draw tube being graduated in single millimeters, every tenth line numbered.

Focusing Adjustment—Coarse adjustment is by rack and pinion. The fine adjustment consists of a sensitive and precise but extremely rugged micrometer screw to withstand rough handling to which microscopes used in travelling are naturally subjected. One micrometer head is equipped with divided drum with vernier which records the lateral displacement of the microscope tube within 0.004mm and consequently permits accurate measurements of the thickness of specimens.

Stage—Of metal, completely covered with vulcanite; measures 90 x 90mm; provided with stage clips. It is mounted to a strong inclinable bracket to permit its folding parallel to the pillar.

Substage—Simplified model with two-lens condenser N.A. 1.20 in swing-out mounting, having iris diaphragms above and below condenser, provided with quick acting screw for raising and lowering the condenser; the substage is swung out of optical axis when the screw reaches the limit of its downward motion; mirror with plano and concave surfaces has universal adjustment and is mounted to swinging arm for oblique illumination.

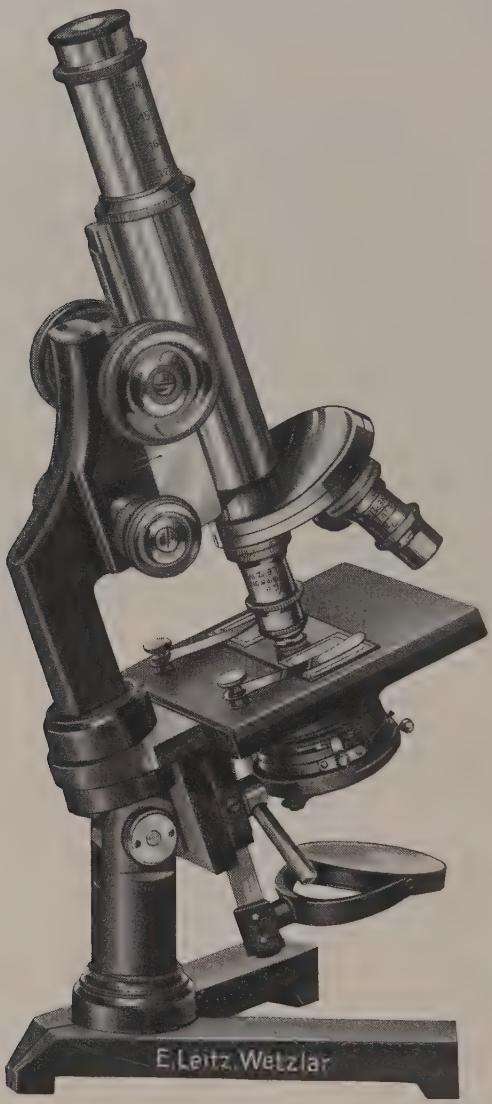
Base, Pillar and Arm—The base is of foldable pattern. The pillar has a double joint and friction device to hold stand at any desired angle while stops are provided for horizontal and vertical positions. The arm is of heavy curved form furnishing ample space for large specimens.

Finish—In alcohol-proof lacquer throughout.

Case—Covered with strong leather, velvet lined, corners protected by metal trimmings.

(Continued on page 82)

LARGE TRAVELLING MICROSCOPE "DT"—(Continued)

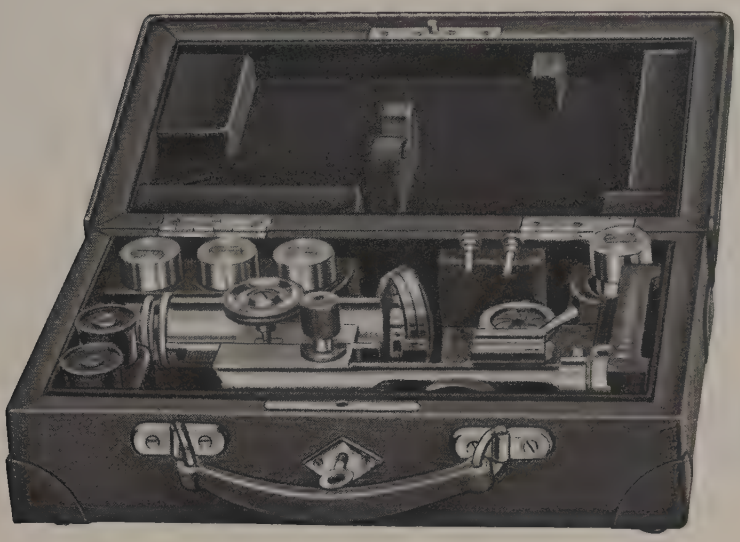


(Shown in upright position, ready for use)

Code Word	Cat. No.	Designation	Price
ACEIM	**DT-10a**	**Microscope "DT",** including simplified screw substage, with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **10a*** (*Magnification: 60-1000 X*)	$
ACENV	**DT-20a**	**Microscope "DT",** including simplified screw substage, with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, optical equipment No. **20a*** (*Magnification: 60-950 X*)	
ACEON	**DT-40**	**Microscope "DT",** including simplified screw substage, with **two-lens** condenser N.A. 1.20; **triple** dustproof nosepiece, **without** objectives or oculars	
DECBD	**22620**	**Mechanical Stage,** for microscope "DT"	

** These optical equipments are itemized on pages 35-36 and in separate pamphlet No. 1138, found in the pocket at front inside cover.*

SMALL TRAVELLING MICROSCOPE "ST"



(Folded in leather case, 27 x 17 x 9½cm)

Due to its compact but rigid construction, model "ST" represents the most ideal type of travelling microscope. It is equipped with a special condenser of N.A. 1.00 with iris diaphragm. The foot is of foldable pattern. The stage is mounted to a strong bracket supplied with joint for folding parallel to the pillar. The case is covered with strong leather, velvet lined, and the corners are protected by metal trimmings.

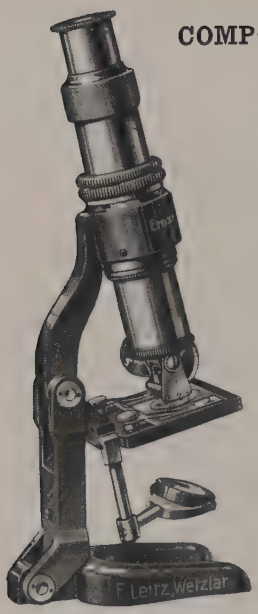
Code Word	Cat. No.	Objectives		Huyghenian Oculars	Combined Magn.	Nosepiece	Special Condenser	Price
		Dry	Oil Immersion					
		Achromatic						
ACECW	**ST-6**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Double	None	$
ACEFT	**ST-8**	**10X** (16mm) **45X**† (4mm)	**None**	6X-10X	60-450X	Triple	N.A. 1.00	
ACEGS	**ST-10**	**10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30	6X-10X	60-1000X	Triple	N.A. 1.00	
ACEHI	**ST-40**	**Microscope "ST"**, including **special** condenser N.A. 1.00; **triple** dustproof nosepiece, **without** objectives or oculars.....						

† With long working distance.

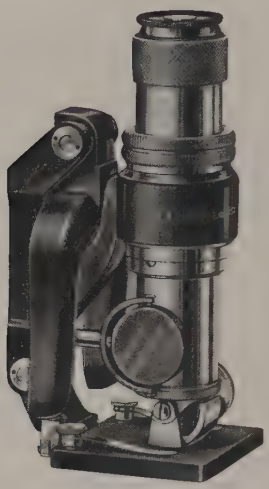
Note: Microscope "ST" cannot be used with mechanical stage.

COMPOUND POCKET MICROSCOPE "MINOR"

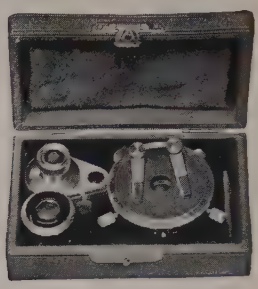
(Patented)



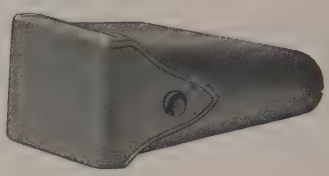
"Minor" Set Up for Use
2/5 Natural Size



"Minor" folded for Insertion into Pocket Case



Mineralogical Accessories "Minor-5"



"Minor" is universally adapted for nature studies and recommended for the examination of a great variety of objects requiring a wide range of magnifications. It is especially desirable for field work in botany, entomology, mineralogy, geology, and at the same time most serviceable to chemists, industrial laboratories, college and high school students. The magnifications are fully adequate for certain clinical examinations, including blood counting, and due to its extreme portability it is ideal for bedside use by physicians.

ASIDE FROM ITS USE AS COMPOUND MICROSCOPE IT IS LIKEWISE AVAILABLE AS A DEMONSTRATION MICROSCOPE

To utilize it in this manner, the supporting pillar and foot are bent to one line to serve as a handle, and in applying the low power objective it is then available for the examination of objects upon which either the instrument cannot be conveniently placed or the specimen between the foot of the microscope.

Magnification Table

Objective	Fully Contracted Tube	Fully Extended Tube	Numerical Aperture	Free Working Distance, mm
Single Objective of low power	7X	26X	0.05-0.08	124-74
Combination Objective, using **one** lens section only	100X	180X	0.28	3.6
Combination Objective, using **both** lens sections	150X	250X	0.37	0.8

Note: If the draw tube is placed between fully contracted and fully extended positions, magnifications between those indicated above will be available.

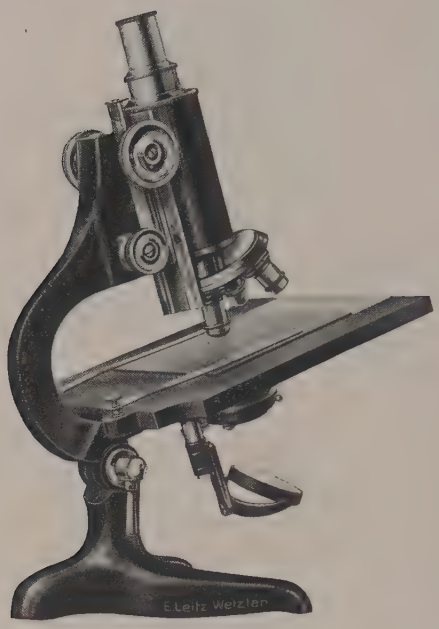
Code Word	Cat. No.	Designation	Price
COBTG	**Minor-1**	**Pocket Microscope "Minor,"** with combination objective, single objective, one ocular, **in compact leather case**	$
COBUP	**Minor-2**	**Pocket Microscope "Minor,"** same as above, but **with simple condenser,** iris diaphragm and holder for filter	
POMIN	**Minor-5**	**Mineralogical Accessories** for above microscope, consisting of attachable rotary stage with vernier, stage being provided with centering screws to allow centering of object toward objectives; slider for selenite plate, attachable polarizer and analyzer, the latter in swing-out mounting, selenite plate, **in case**. (By means of the accessories "Minor-5" the pocket microscope can be converted into a petrographic pocket microscope.)	
POXIL	**Minor-6**	**Auxiliary Equipment to Mineralogical Accessories "Minor-5";** this auxiliary equipment consists of: one "Bertrand" lens with thread for attachment to oculars; one objective **30x** (6mm) with intermediate ring and thread for attachment to the tube; two-lens condenser in separate mount with thread for attachment to the polarizer; set of eight selenite and mica plates to be placed upon the ocular; complete, **in case**	

DEMONSTRATION (HAND) MICROSCOPE "DEM"

Demonstration Microscope "DEM" has been designed for the purpose of passing through the hands of students during lectures, for the demonstration of specimens under discussion. It is available for low and moderately high magnifications. The stage is of square pattern, attached thereto a disc diaphragm with multiple openings; the microscope, however, can likewise be furnished with a two-lens condenser N.A. 1.20 and for magnifications of higher power with a special fine adjustment (micrometer screw). The coarse focus is accomplished by sliding the tube. When the specimen is in proper focus, the tube may be securely clamped in place by means of a clamping device.

Code Word	Cat. No.	Designation	Price
ALBLG	**DEM-1**	**Microscope "DEM",** stand only, **without** objectives or oculars, stage provided with disc diaphragm, **in case**.....	$
ALBML	**DEM-2**	**Microscope "DEM",** same as above, but **with** achromatic objective **10X** (16mm) *"Huyghenian"* ocular 5X (*Magnification: 50X*), **in case**.....	
ALBOB	**DEM-3**	**Microscope "DEM",** with fine adjustment (micrometer screw) for high magnifications, **two-lens** condenser N.A. 1.20 having iris diaphragm underneath, **without** objectives or oculars, **in case**.....	
ALBPS	**DEM-4**	**Microscope "DEM",** same as above, **with** achromatic objectives **10X** (16mm) and **45X** (4mm), *"Huyghenian"* ocular 5X (*Magnification: 50-225X*), **in case**.....	

BRAIN MICROSCOPE "BRN"



Microscope "BRN" **permits the examination of entire brain sections.** The stand is of unusually large dimensions and has primarily been designed for the examination of large brain sections. The general construction is in conformity with standard patterns of Leitz Microscopes while model "BRN" is supplied with a fixed square stage measuring 200 x 200mm by means of which it accommodates the largest sections likely to require microscopical examination. The dimensions of the entire microscope are proportionate to the stage. The tube is of 50mm diameter and affords with low power objectives a view of the entire preparation. The stand is likewise adapted for photo-micrography.

In addition to the rack and pinion for coarse adjustment, the microscope is equipped with a micrometer screw for fine adjustment, rendering it available for use with objectives of high magnification.

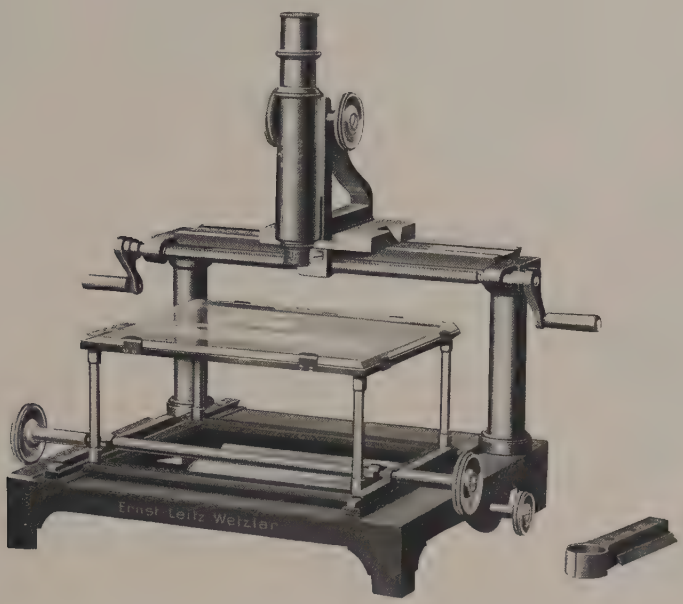
The microscope is supplied with a simplified quick screw substage equipped with two-lens condenser N.A. 1.20.

Code Word	Cat. No.	Designation	Price
CERUT	**BRN-2**	**Microscope "BRN",** as described, with simplified quick screw substage equipped with **two-lens** condenser N.A. 1.20, **without** objectives, oculars or nosepiece **in case**	**$**

Note: For reasons that the optical equipment is to be individually selected for the particular mode of investigation for which the microscope is desired, we refrain from listing the instrument with objectives or oculars; for selection of suitable objectives, we refer to pages 16-17 and for oculars, to page 18.

NEBELTHAU'S TRAVERSING MICROSCOPE "NTM"

(For the examination of large objects, such as brain sections, etc.)



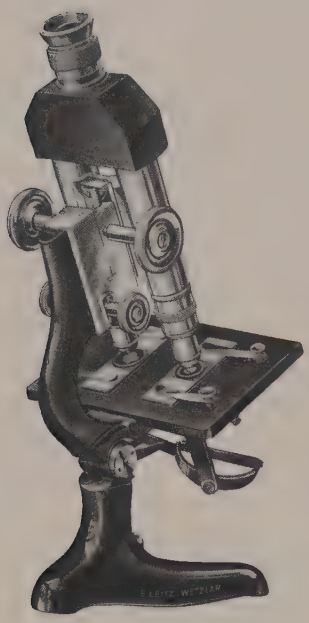
Microscope "NTM" represents an instrument by means of which very large objects such as sections of the entire brain, cultures, etc., may be examined systematically.

The microscope is mounted to a travelling carriage running on a heavy bed supported by two stout pillars, the stage travelling beneath this structure. The various movements are accomplished by combined motions of the microscope as well as of the stage on brackets at right angles to each other. The microscope is propelled by a worm drive, the stage motion being accomplished by a double rack and pinion. The extent of each movement is indicated in either case by scales, thus affording means of systematically examining the entire object. The stage consists of a glass plate measuring 200 x 160mm and is carried by a frame supported by four pillars. The range of motion of the microscope is 180mm and that of the stage 135mm. A rectangular adjustable mirror provides ample illumination. The microscope tube is so arranged that it can be easily removed from the stand and replaced by a magnifier. The coarse adjustment is effected by rack and pinion while a micrometer screw, attached to the lower end of the tube, acts as fine adjustment.

Code Word	Cat. No.	Designation	Price
NEBAU	NTM	**Microscope "NTM"**, as described, **without** objectives or oculars, but with lens holder and triplet magnifier 8X, No. 225	$
NEGLA		**Moulded Glass Dish** of the same size as the stage, to hold very large sections	

Note: For reasons that the optical equipment is to be individually selected for the particular mode of investigation for which the microscope is desired, we refrain from listing the instrument with objectives or oculars; for selection of suitable objectives, we refer to pages 16-17 and for oculars, to page 18.

COMPARISON MICROSCOPE "COMP"



This microscope consists of a stand of regulation size equipped with two tubes each of which is to be supplied with an objective which in focal length and magnifying power correspond to each other. The stage provides sufficient space for the accommodation of two specimens for comparison.

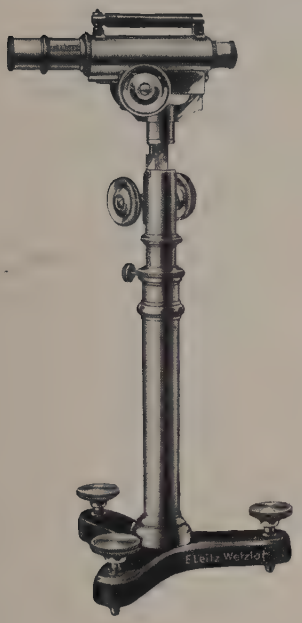
Separate mirrors as well as condensers are available for the proper illumination of each tube unit in an identical manner as arranged with microscopes of standard type. The coarse focusing adjustment is attained simultaneously for both tubes by means of rack and pinion, and micrometer screw for fine adjustment. In order to compensate for a possible deviation in the magnifying properties of both objectives used for comparison, a separate micrometer screw attached to one tube serves as a correction medium.

A prism unit in housing unites both tubes, directing the images of both objectives to the ocular of *"Ramsden"* type, which has an initial magnification of 9X. The images are formed within the lower focal plane of the ocular which at the same time coincides with the upper surface of the prism. Each objective projects a semi-circular image and these combine into one complete field within the ocular, divided, however, by a sharp hair line formed by the adjacent edges of the prisms. So as to permit a sharp focus upon the dividing line, the ocular is provided with a focusing collar.

Code Word	Cat. No.	Designation	Price
CIFAX	**COMP-40**	**Microscope "COMP",** as described, with **two** two-lens condensers N.A. 1.20 having iris diaphragms underneath, **two** plano concave mirrors attached to universal joint, **without** objectives, **in hardwood case** with lock and key	$
CIFBY	**COMP-1**	**Microscope "COMP",** same as above, but with **two** each achromatic objectives **3.2X** (40mm) and **10X** (16mm)	
CIFCT	**COMP-6**	**Microscope "COMP",** same as above, but with **two** each achromatic objectives **10X** (16mm) and **45X** (4mm)	
CIFDJ	**COMP-10**	**Microscope "COMP",** same as above, but with **two** each achromatic objectives **10X** (16mm), **45X** (4mm) and **two** oil immersions **100X** (1.8mm) N.A. 1.30	

Note: We likewise refer to comparison ocular listed on page 157.

VERTICAL READING MICROSCOPE "VRM"



Microscope "VRM" consists of a tube placed horizontally upon a vertical column, the latter, by means of a telescopic slide and rack and pinion movement, is adjustable in height from 340-550mm. The vertical column is supported by a tripod base provided with levelling screws and box level. A millimeter scale and vernier at the vertical column indicate the magnitude of vertical displacement within 0.1mm.

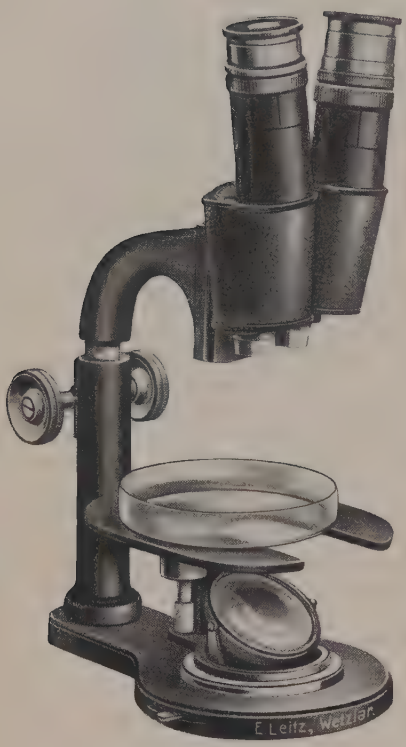
The microscope tube has mounted to it a water level and may thus be made to rotate in a strictly horizontal plane when adjusting the levelling screws attached to the tripod. While the microscope can likewise be used with the standard range of low power objectives, for large working distances, we recommend the divisible objective regularly supplied with the equipment. This objective consists of two segments of which either both together or the front or back combination may be used separately, thus obtaining those optical characteristics as are explained in the following; viz.,

	Both Segments Together	Front Segment Alone	Back Segment Alone
Free Working Distance:	50mm	90mm	480mm
Magnification:	20X	12X	3X
Field of View, Diameter:	6.5mm	10mm	38mm

The microscope may be focused with respect to the object by means of rack and pinion. The ocular is provided with a micrometer 10mm divided into 100 parts and by means of this micrometer, the utility of the instrument is still further enhanced when fine and accurate measurements are to be made.

Code Word	Cat. No.	Designation	Price
READE	VRM	**Microscope "VRM"**, as described, with special divisible objective, ocular and micrometer 10mm : 100 parts.....	$

BINOCULAR CULTURE MICROSCOPE "BSM-X"

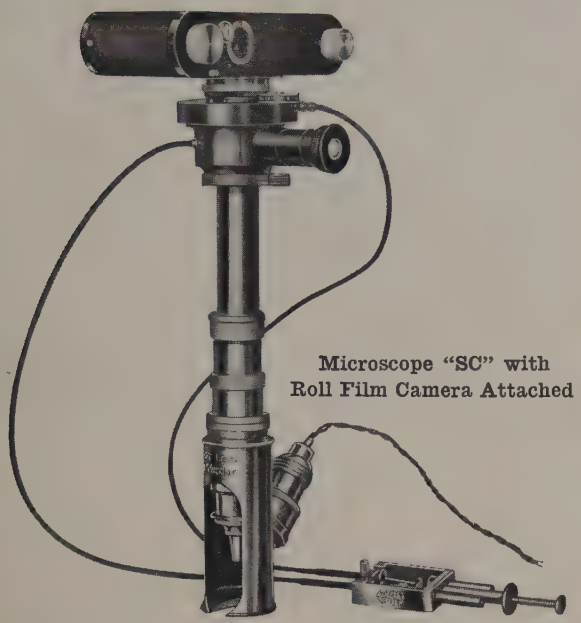


With the introduction of the special culture microscope "BSM-X," we believe an instrument is offered to find a ready appeal to all bacteriologists. It consists of a base with pillar mounted to the latter and a rack and pinion which focuses the arm holding the binocular prism body. The prism body affords adjustment to interpupillary distance and is equipped with a pair of stationary mounted objectives while four different pairs of oculars ranging in magnifying power from 10X to 40X may be used interchangeably.

The microscope "BSM-X" employs a new method of holding the culture dish and this through the means of a rubber suction cup fastened to a hemispherical stage. This stage, by reason of its form, permits the culture dish to be oriented to any angle while the suction cup holding the dish firmly does not, however, prevent an easy movement of the dish upon the stage so that consequently, every portion of the culture may be examined conveniently. Against the hemispherical stage is interchangeable a stationary mounted stage with plano-convex mirror and this stage is made to serve for examination under transmitted light. Two arm rests act as an arm or hand support while inoculating cultures.

Code Word	Cat. No.	Designation	Price
ATNHD	**22204**	**Microscope "BSM-X",** consisting of stand with rack and pinion, tube support, hemispherical stage provided with supporting sleeve and rubber suction cups, stationary stage with plano and concave mirror, two arm rests, **without** case	$
LUBOS	**22102a**	**Binocular Prism Body** with one pair of stationary mounted objectives	
ARYDI	**22106**	**Pair of Oculars "A-5",** magnification **10X,** field of view **16**mm, working distance **80**mm	
ARYES	**22108**	**Pair of Oculars "A-10",** magnification **20X,** field of view **10**mm, working distance **78**mm	
ARYFE	**22110**	**Pair of Oculars "A-15",** magnification **30X,** field of view **7**mm, working distance **75**mm	
ARYLY	**22111**	**Pair of Oculars "A-20",** magnification **40X,** field of view **6**mm, working distance **70**mm Note: *One ocular of the above pairs is provided with adjustable eyelens to correct against difference in the observer's eyes.*	
ATNJH	**22206**	**Wooden Cabinet** to accommodate above items	
ATNNK	**22209**	**Microscope "BSM-X" complete,** including items No. 22204-22206	

SMALL SKIN (CAPILLARY) MICROSCOPE "SC"



Microscope "SC" with Roll Film Camera Attached

The above illustration shows the enlargement made of the original photograph in the left-hand corner taken through the microscope "SC" using the roll film camera.

Microscope "SC" is arranged to be either placed upon the skin or for insertion of the finger. It is equipped with one ocular and special objective as well as illuminant, the latter consisting of a lamp 8-volt, 0.6-amp. The illuminating arrangement is furnished with a changing device for filter holders and includes one filter holder with stationary mounted illuminating lens, one filter holder empty, and one each contrast and heat absorption filter. The contrast filter is applied during photography while the heat absorption filter is made use of through visual observation in order to avoid the skin portion being subjected to excessive heat.

Correct illumination is obtained by marking on paper a dot or cross and focusing upon it by bringing the mark within the center of the field. This accomplished, the tube is locked tightly and the illuminating rays are then centered upon the marking on the paper. The coarse focus having been obtained and the tube having been clamped in place, the fine adjustment is then attempted by means of the knurled ring at the tube.

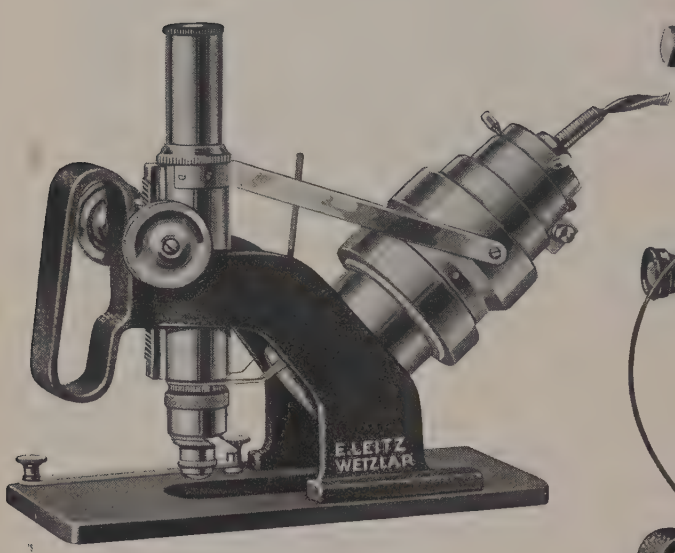
After the observation ocular has been unscrewed from the microscope tube, the roll film camera may be attached and by means of the clamping ring, situated behind the camera ocular, screwed into place. The side telescope of the camera controls the focus during photography and since this device represents the very same arrangement supplied with roll film attachment camera listed on pages 202-203, we suggest that this page be consulted for further details.

The special objective with which this roll film camera is equipped renders a magnification which equals one-ninth of the magnification obtained under visual observation. Inasmuch as the initial magnification of the objective and likewise of the ocular is for both 8X, it follows that the size of the photographed image results in 64:9 or approximately 7X. The time of exposure is one-tenth second when using Leitz special film, applying the lamp provided which has a strength of 0.6-amp.

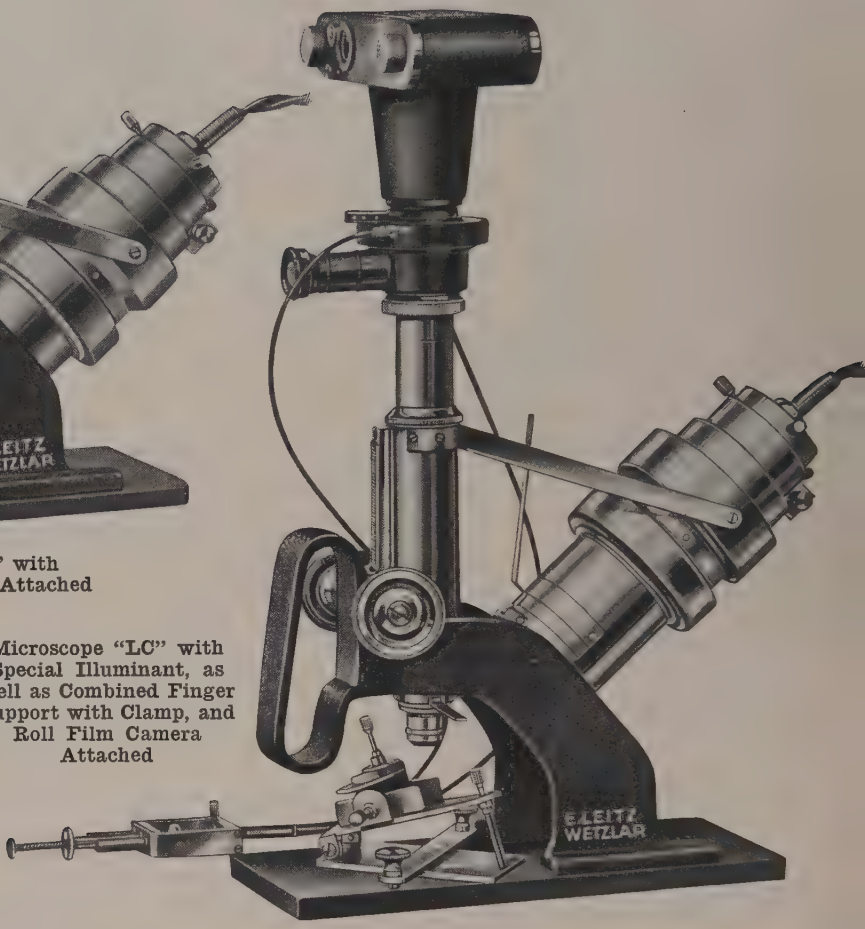
When making exposure of only one person at a time, it is suggested to insert into the camera short film strips only to take several pictures and then to simply develop these strips utilizing the customary trays. Enlargements can be made by means of the universal enlarging apparatus No. 35480, listed on page 282.

Code Word	Cat. No.	Designation	Price
GANAWOLE	**SC**	**Microscope "SC",** complete with ocular, special objective, illuminant with lamp 8-volt, 0.6-amp., one extra lamp bulb, changing device for filter holders, one filter holder with stationary mounted illuminating lens, one filter holder empty, one contrast filter, one heat absorption filter	$
KAFILMCA	**27720**	**Special Roll Film Attachment Camera** for microscope "SC", for cinema film, with side telescope, instantaneous shutter, special ocular, two film magazines, two wire releases	
GANOWONI	**27740**	**Automatic Release Attachment,** by means of which both wire releases (included under No. 27720) can be utilized as one unit	
REKEY	**32978**	**Adjustable Rheostat,** 110-220 volt, with ammeter, for use with lamp included under No. "SC"	
LISEY	**32980**	**Lamp Bulb,** 8-volt, 0.6-amp	

LARGE SKIN (CAPILLARY) MICROSCOPE "LC"



Microscope "LC" with Special Illuminant Attached



Microscope "LC" with Special Illuminant, as well as Combined Finger Support with Clamp, and Roll Film Camera Attached

With the ever-increasing importance attached to the study of capillary circulation, the Leitz Works found it advisable to construct the special type of skin (capillary) microscope "LC" of universal model. This instrument has the advantage that through use of the ingeniously devised combination finger support and clamp, the capillaries of the nail-fold of the index finger can be studied while at the same time, the microscope may be placed upon any part of the body for examination of the capillaries of the skin or general studies of the skin as well. As the most suitable place for studying the capillaries, the nail-fold of the index finger is usually selected. After the finger has been carefully cleansed with green soap and water, it should then be covered with cedar-oil for the reason that the latter adds a certain amount of transparency.

The microscope "LC," because of its special design, has several distinct features: 1. It is provided with a strong handle for convenient use from one part of the body to another; 2. Large extension arm holding the microscope tube affording sufficient space for the accommodation of body parts such as the hand, arm, etc.; 3. Special illuminating unit attached to the tube, which when once adjusted retains its position for reasons of moving with the microscope tube when focusing; 4. Special combination support and clamp for the finger; 5. Means of photographing the capillary action.

The illuminant consists of the special low-voltage lamp 6-volt, 5 amp., equipped with collimator illuminating system. This lamp is endowed with an extraordinary light capacity permitting of

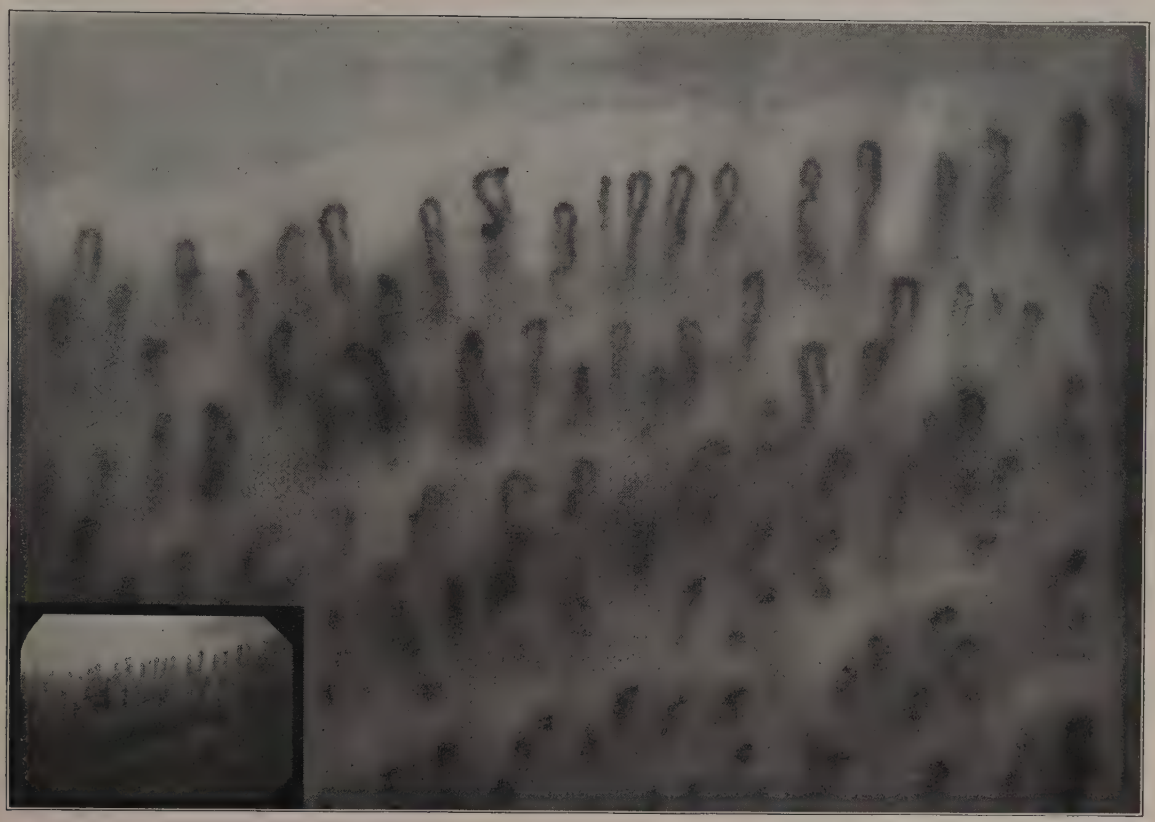


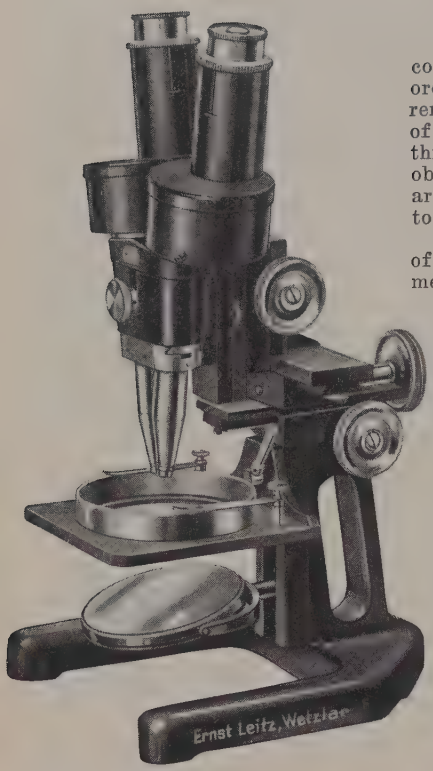
Photo-Micrograph of Capillaries

variation in the light intensity through the use of an adjustable rheostat or transformer, respectively. Due to the large volume of light, this lamp offers special advantages during photo-micrography of the capillary action and consequently reduces the time of exposure.

The roll film attachment camera No. 27700, listed on pages 202-203, is especially recommended for use with the Microscope "LC" and the illustration on page 92 gives proof of the excellent results to be expected when recording the capillary action photographically.

The above illustration represents an enlargement made of the original photograph in the left-hand corner taken through the microscope "LC" using the roll film attachment camera No. 27700.

Code Word	Cat. No.	Designation	Price
LEDGA	LC	**Microscope "LC"** consisting of base plate with tube bracket; tube with rack and pinion focusing adjustment; micrometer screw attached to the lower portion of the tube for fine adjustment; illuminant including the special low-voltage lamp with three-lens condensing system, cord and plug; one interchangeable filter holder; one yellow filter; one heat absorption filter; one adjustable combination finger support and clamp; the microscope complete with one ocular and special objective K—8X..... **Note:** *Since the low-voltage lamp included with the above equipment is to be used with a rheostat or transformer dependent upon the existing current conditions, we refer to Nos. 32855-32870 page 162 for selection of these accessories.*	$
MIFILMCA	**27700**	**Roll Film Micro Attachment Camera,** for standard cinema film, picture size 24x36mm (1⅜x1 in.), with one film magazine, side telescope, instantaneous shutter, two wire releases, "*Periplan*" ocular 8X, **in case**.....	
GANOWONI	**27740**	**Automatic Release Attachment,** by means of which both wire releases (included under No. 27700) can be utilized as one unit..	



ORE DRESSING MICROSCOPE "MDO"

This microscope is primarily intended for the examination and control of mining products either in the form of grains or as crude ores. In its general construction, it consists of a binocular microscope rendering stereoscopic and erected images at magnifications in steps of 12.5, 18, 25, 36, 50 and 72X. These magnifications are obtained through interchangeable use of two pairs of oculars and three pairs of objectives. The prism housings, jointed at a slight angle to each other, are rotatable about their axis so as to enable the user to adapt these to the interpupillary distance of his eyes.

For measuring and counting the grains, two sets, each consisting of six ocular net micrometers, are supplied. One set is ruled in the metric system and the other in inches; for instance:

Ocular Net Micrometer Set I:

Net-Division measuring 10mm divided in:	10	15	20	50	100	133 parts
Corresponding to **interval distances** or micrometer values, respectively:	1.0	0.67	0.5	0.2	0.1	0.075**mm**

(When using objective pair 1X)

Ocular Net Micrometer Set II:

Net-Division measuring 10mm divided in:	24	34	48	68	96	135 parts
Corresponding to **interval distances** or micrometer values, respectively:	0.417	0.294	0.208	0.147	0.104	0.074 **in.**

(When using objective pair 1X)

One complete net division of the ocular micrometers covers one square centimeter of the net division at the microscope stage plate. When measurements are made with other pairs of objectives, it naturally follows that the above micrometer values have to be recalculated accordingly, since for instance, for the objective pair 2X, the values are one-half while with the objective pair 4X, they equal one-quarter of the figures outlined in the above tables. The micrometer discs are to be inserted into the ocular with adjustable eyelens of the ocular pairs 12.5X or 18X, respectively and then correspond when using the objective pair 1X to the sieve values used in sifting the material.

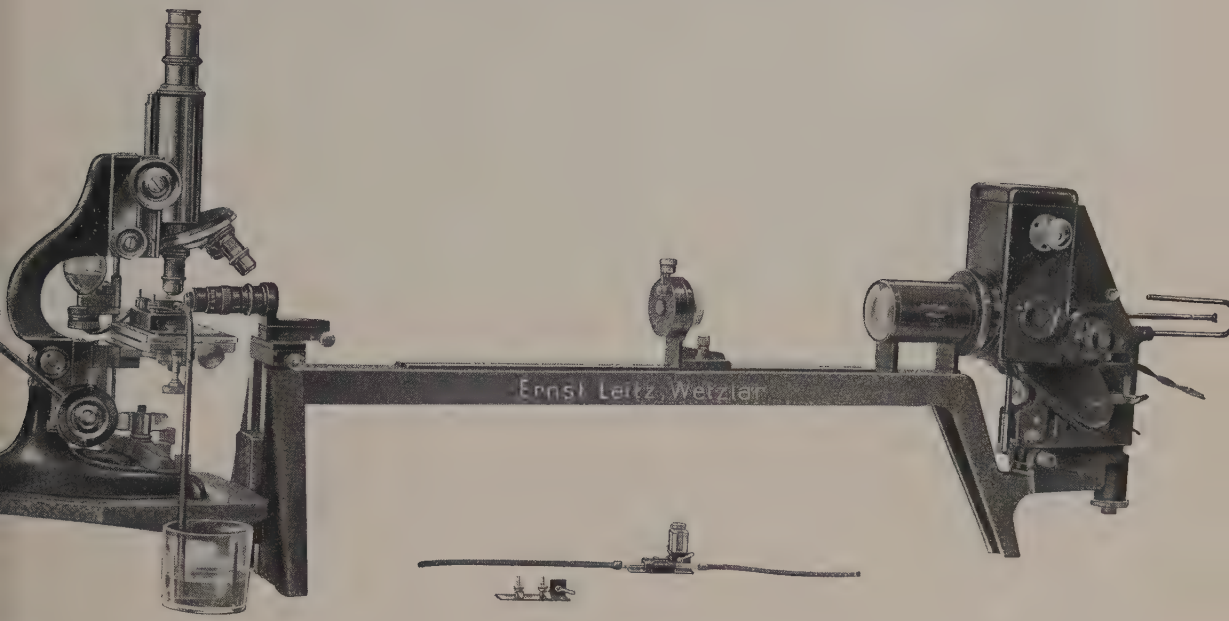
The microscope stand proper is equipped with two rack and pinion motions affording the microscope tube a horizontal displacement of 50mm within two directions at right angles to each other. A vertically arranged rack and pinion device serves as focusing adjustment. The microscope stage as well as the mirror are detachable so as to permit the examination of large objects to be placed between the foot of the microscope, or those objects on which the microscope is made to rest. The stage has a large opening which may be closed through the insertion of a metal disc. The stage opening will readily accommodate a round trough consisting of a glass bottom and metal ring, the glass bottom being provided with divisions in square centimeters, to facilitate counting grains. So as to obtain a perfectly even illumination, the back of the mirror carries a milk glass plate for diffusion.

The objectives as well as oculars furnished with the ore dressing microscope are engraved with their respective initial magnifications, and multiplying the magnification number of the objective used with the magnification number of the ocular used in conjunction with it, the combined magnifying power is thus obtained.

Code Word	Cat. No.	Designation	Price
LEDIB	**MDO**	**Microscope "MDO",** as described, consisting of: Binocular body tube One each pair of objectives 1X, 2X and 4X Detachable objective adapter for use with objectives 2X and 4X (this adapter is not applied when using objective pair 1X) One each pair of oculars 12.5 and 18X of wide diameter (each pair has one ocular supplied with adjustable eyelens) Glass trough with bottom ruled in net divisions (to be inserted into the stage opening) Micrometer discs, set I, consisting of six ocular micrometers divided in metric units Micrometer discs, set II, consisting of six ocular micrometers divided in inch units Complete **in case,** with lock and key	$

SLIT ULTRA MICROSCOPE "SUM"

For the Examination of Ultra Microscopic Elements in Solution as well as Solid Substances



It is well known that the resolving power of microscopes has its limitations since it is dependent upon the wave lengths of the illuminating rays and the numerical aperture of the objective. The slit ultra microscope is to serve making visible such minute particles falling below the border resolving power attainable with microscopes. Off and on, different types of equipments to serve this purpose appeared on the market but in most instances the apparatus offered fell far below the working capacity claimed for them. The Leitz Works, who for years have occupied a leading position in the construction of darkfield condensers used successfully for the examination of colloidal solutions, realized the importance of devising a slit ultra microscope equipment possessing all those features by which the micro study of colloids would receive a renewed stimulus so as to permit quantitative measurements of colloidal particles, while darkfield condensers were limited to demonstration of the most characteristic microscopic phenomena: *"Brownian"* motion. With this in mind, the Leitz Slit Ultra Microscope has been constructed and claims for itself numerous advantages, of which may be mentioned specifically:

1. **Simplicity of operation** through the use of one single rider, while other instruments provide multiple units for adjustment;
2. **Illuminating system remains permanent** and does not require realignment;
3. **The coincidence of the depth of illumination with depth of focus is accomplished in an exceedingly simple manner** through definitely determinable slit images by means of one single objective with correction collar. (*The forming of an intermediate image as with apparatus of other make is thus avoided.*)
4. The index marks at the optical bench correspond to the graduation scale at the correction mount of the illuminating objective and thus a ready adjustment is accomplished.
5. For reasons that each observation magnification results in a specific depth of focus (depth of illumination), the relative position of the slit rider as well as the corresponding index at the objective collar may be pre-determined with the available table contained in the directions. (*In contrast to this feature, equipments of other manufacture necessitate a multiple adjustment of slit rider, objective rider, and the rider of the illuminating system.*)
6. For the reason that the microscope support is adjustable in height, any available microscope of modern type can be used.

The source of light used in the Leitz Slit Ultra Microscope consists of the new automatic arclamp with clockwork mechanism providing for a stationary homogeneous crater, the lamp being equipped with collimator illuminating system. The precision slit is thoroughly protected against dust and furnished with a device for symmetrical adjustment, permitting the width of the slit to be read within 0.01mm. A non-cemented quartz trough is available, arranged to afford easy cleaning and at the same time precluding the possibility of breakage to the coverglass.

Adjustment of the Microscope:

The correction collar of the illuminating objective as well as the slit rider must be set to marks of coincidence. The cross motions controlling the movement of the illuminating objective are to be set to center position. To trace the course of rays, a uranium glass cube is substituted for the quartz cell. Thus having determined the correct slit image, the microscope is carefully locked in place so as not to disturb this adjustment.

After the preliminary adjustment by use of the uranium glass cube has been accomplished, the quartz cell is replaced and thus only a final adjustment is required towards regulating the height of the quartz cell correctly relative to the entrance pencil of light. The light is to enter in such

(*Continued on page 96*)

SLIT ULTRA MICROSCOPE "SUM"—(Continued)

manner that the upper bordering limit of the pencil strikes immediately below the lower surface of the coverglass. With the increase in magnification, the accuracy of this adjustment increases in importance. To facilitate the easy adjustment of the quartz cell to the proper height when using objectives of high power, an auxiliary device acting as fine adjustment for the quartz cell is provided.

It is to be emphasized that a microscope especially constructed for the use with the slit ultra equipment facilitates the determinations to a much greater extent than if one of the available microscopes in the laboratory be resorted to. **We have, therefore, listed the slit ultra equipment in connection with a special microscope** (illustrated on page 95), **and furthermore, a similar equipment including, however, those accessories required when one of the microscopes available at the laboratory, is used.**

It has lately been found that observation of ultra microscopical particles under polarized light is of considerable importance for reasons that certain optical phenomena of these particles can only be determined by means of a polarization effect, not visible under ordinary illumination conditions. The slit ultra microscope described is therefore furnished by us with appropriate accessories for study under polarized light.

We refrain from enumerating the essential details as relate to the determination of the depth of focus and depth of illumination for reasons that this data as well as the required tables on the subject are contained in the booklet of directions which accompanies the Leitz slit ultra microscope.

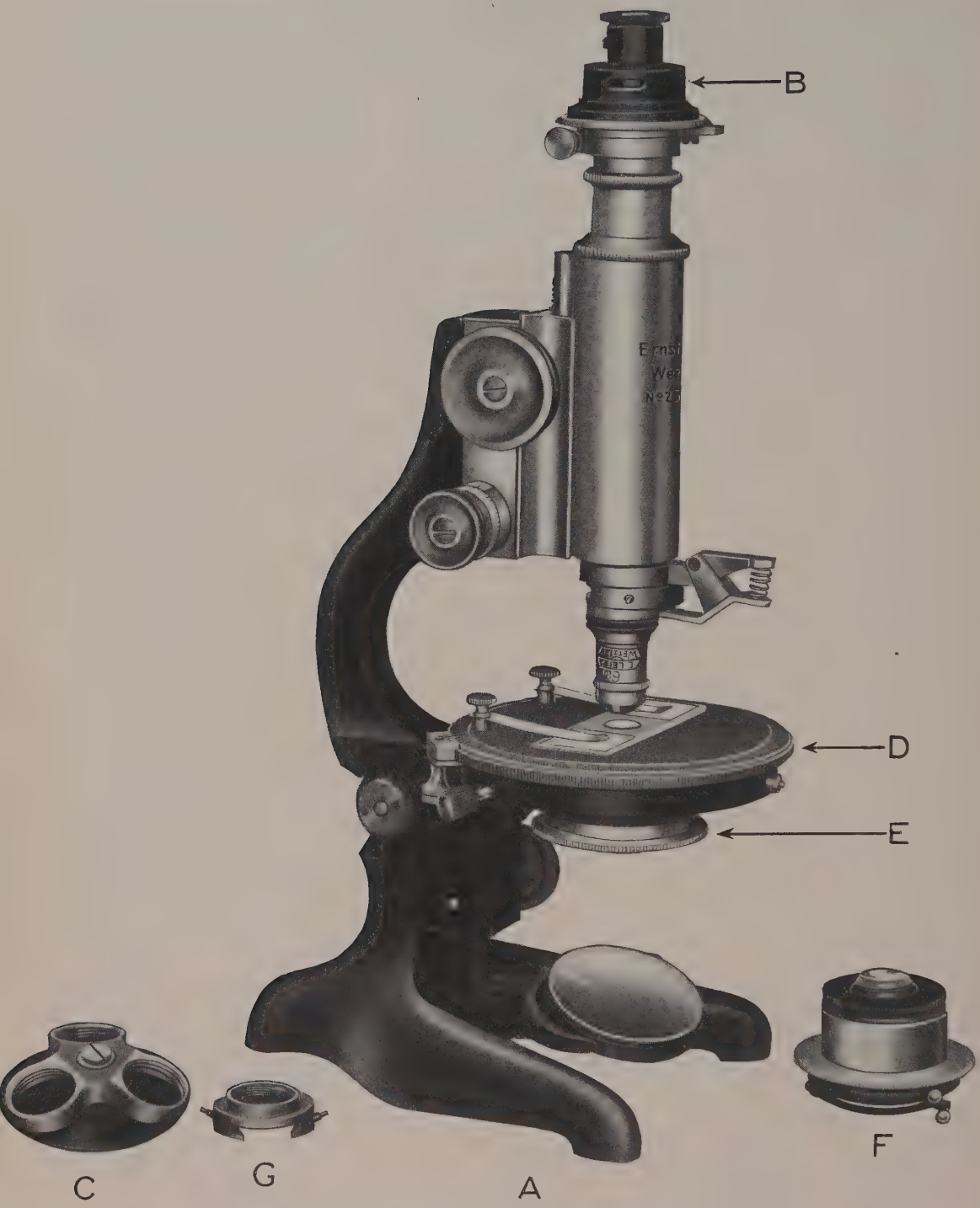
Code Word	Cat. No.	Designation	Price Unit	Price Total
RACIB	**32500**	**Optical Bench,** with new automatic-feed arclamp (carbons controlled by clockwork mechanism), in light-tight housing with crater-mirror; collimator illuminating system; precision slit on rider; illuminating objective with correction collar on rider, provided with cross motion at right angles; microscope base plate		
RACJE	**32505**	**Special Microscope,** as illustrated on page 95, with mechanical stage adjustable in three directions vertically to each other; object support; adjustable draw tube with millimeter scale; rack and pinion for coarse focus and micrometer screw for fine adjustment (the micrometer screw is furnished with one divided head with vernier recording the lateral displacement of the microscope tube within 0.002mm)		
RACKD	**32510**	**Quartz Cell,** non-cemented, in mounting, affording easy cleaning and protection against breakage of coverglass, complete with ten coverglasses		
RACLI	**32515**	**Glass Thistle Tube,** with rubber tubing, pinchcock and pillar for mounting to the microscope base plate		
RACMG	**32520**	**Uranium Glass Cube,** mounted to object slide		
RACNF	**32525**	**Total Equipment Nos. 32500-32520**		
		As Suitable Optical Equipment, We Recommend:		
ACLEN	**22012**	**Achromatic Objective, 20X** (10mm)		
ACMAT	**22017**	**Achromatic Objective, 45X** (4mm)		
WATES	**22019**	**Achromatic Water Immersion Objective, 50X** (3.6mm) N.A. 1.0		
IRTIS	**22564a**	**Objective Body with Iris Diaphragm,** to serve for the variation of the objective aperture (interchangeable against objective body)		
PROJI	**22068a**	*"Periplan"* **Ocular 6X** with adjustable eyelens, without crosshairs		
PROUP	**22072a**	*"Periplan"* **Ocular 10X** with adjustable eyelens, without crosshairs		
RACXW	**32585**	*"Ramsden"* **Ocular 20X** with adjustable eyelens, without crosshairs		
PROVQ	**32530**	**Ocular Micrometer Disc,** graduated in squares, each square 0.5mm		
PROWZ	**32535**	**Ocular Micrometer Disc,** graduated in squares, each square 1.0mm		
PROXV	**32540**	**Ocular Micrometer Disc,** graduated in squares, each square 2.0mm		
DECNH	**22660**	**Object Micrometer,** 2mm divided in 200 parts		
PROYG	**32545**	**Total Equipment No. 32525 and Optical Equipment listed above**		
		Forward:		

(*Continued on page 97*)

SLIT ULTRA MICROSCOPE "SUM"—(Continued)

Code Word	Cat. No.	Designation	Price Unit	Price Total
		Brought Forward:		
		Note: The items No. 32550 or 32555 respectively, as well as No. 35560 are required for the examination of ultra microscopic particles in polarized light.		
PROZN	**32550**	**Anastigmatic Tube Analyzer,** in slidable mounting and turnable to its axis by 90°, attachable to the **special** microscope No. 32505, **additional** to Microscope No. 32505.....		
		Note: *If the anastigmatic tube analyzer No. 32550 is desired to be attached to an* ***available*** *microscope, it is essential that we be advised of the model involved and its serial number so that we may determine if it is possible to make this adaptation and eventually quote price.*		
PRONF	**32560**	**Polarizer,** on rider, to be attached to the optical bench of the slit ultra microscope; the polarizer being provided with rotary mount, turnable to its axis within 90°.....		
		Note: *The polarizer No. 32560 can be used either with the* ***special*** *microscope No. 32505 or an* ***available*** *microscope at the laboratory.*		
RACOC	**32565**	**Slit Ultra Microscope "SUM"** complete, **equipment No. 32545,** as well as **Nos. 32550** and **32560**.....		
RACPK	**32555**	**Ocular Analyzer,** to be placed over the ocular of the microscope, provided with clamp for the microscope tube, supplied with socket having graduated periphery and index mark on which the analyzer may be rotated.....		
		For converting an available microscope at the laboratory so as to be suitable for use with the slit ultra microscope, a mechanical stage as well as the items listed under Nos. 32570, 32575 and 32580 are required, it thus not being necessary to order the special microscope No. 32505, nor the Quartz Cell No. 32510.		
		Mechanical Stage, adaptable to an existing microscope (upon receipt of advice as to the model of microscope involved, giving us the serial number, we will then quote on a proper mechanical stage).....	**Price depending upon model to be furnished**	
RACQL	**32570**	**Device for Vertical Adjustment,** attachable to the above mechanical stage; this device facilitates the quartz cell being accurately adjusted to proper height relative to the pencil of rays.....		
RACRN	**32575**	**Quartz Cell,** non-cemented, in mounting, affording easy cleaning, protecting coverglass against breakage; complete with ten coverglasses (this cell is provided with clamp for clamping to the device for vertical adjustment No. 32570).....		
RACST	**32580**	**Small Stage,** for the support of solid substances (with clamp for clamping to the device for vertical adjustment No. 32570)		
		For use of the automatic arclamp included under equipment No. 32500, either of the following rheostats, dependent upon the existing current conditions, is required:		
RACTU	**32665**	**Rheostat, 110-volt** (renders lamp available at 5-6 amp. on D.C. and at 8 amp. on A.C.).....		
RACUP	**32670**	**Rheostat, 220-volt** (renders lamp available at 5-6 amp. on D.C. and at 8 amp. on A.C.).....		
RACUR	**32675**	**Carbon,** 250x5mm (horizontal) for **D.C.** .....per ten		
RACWO	**32680**	**Carbon,** 120x6mm (vertical) for **D.C.** .....per ten		
RACXY	**32685**	**Carbon,** 250x4.5mm (horizontal) for **A.C.** .....per ten		
RACZY	**32690**	**Carbon,** 120x7mm (vertical) for **A.C.** .....per ten		

CHEMICAL MICROSCOPE "CHEM"



Above illustration shows the following equipment:

A) Microscope stand proper;
B) Analyzer above ocular;
C) Triple dustproof nosepiece;
D) Graduated rotatable stage with centering screws;
E) Complete substage with polarizer inserted;
F) Abbe Condenser withdrawn from substage and easily insertable into sleeve in place of polarizer;
G) Centering Objective Adapter for Objective Clutch.

CHEMICAL MICROSCOPE "CHEM"

Mechanical Stand—Of the conventional type with base of modified horseshoe form, having rounded contour; heavy joint with double bearing hinges the arm to foot with pillar and serves for inclination; stops are provided for vertical and horizontal limits.

Arm—Curved form, serves as convenient handle and provides ample space for manipulating large objects (distance from center of stage to arm is 90mm).

Focusing Adjustment—Rack and pinion, provided with stop to prevent pinion from overriding rack, serves as coarse focus. The micrometer fine adjustment consists of the same precise construction as supplied with Leitz research microscopes, the milled head on the right-hand side is equipped with divided drum for depth measurements of specimens (one interval of the scale equals 0.004mm displacement of the tube). The micrometer adjustment is provided with a safety device and thereby ceases to operate when the objective touches the specimen whereby injury to objectives and specimens is precluded.

Stage—Of **round** and **revolving** pattern with milled edge for easy rotation; periphery is graduated with every tenth line numbered and a vernier permits reading within 0.1 degree; a clamping screw is provided by means of which the stage may be arrested at any desired position. Two centering screws permit convenient centering of the stage. The latter measures 110mm in diameter and is equipped with two stage clips. (It can be provided with either mechanical stages Nos. 22614 *listed on page 171,* or 2230, *listed on page 115.*)

Substage—Adjustable for focus by means of precise rack and pinion movement of extensive range, its sleeve accommodates the polarizer.

Polarizer—Consists of a *"Nicol"* prism mounted in spring sleeve and therewith inserts into the substage frame; the polarizer is equipped with a condensing unit so as to be likewise available for use with high power objectives.

Analyzer—Consists of a *"Glan-Thompson"* prism, mounted to permit rotation; a clamping screw socket with index fits over the ocular on the microscope tube and the analyzer rests upon this socket where it is rotatable. The mounting of the analyzer is equipped with a graduated collar, every tenth line being numbered, to permit reading the degree of rotation. The mounting being provided with a slit, permits the use of compensators.

Mirror—One side plano, the other concave, 50mm diameter and adjustable in two planes, provided with fork and mounted to swinging arm.

Finish—Reagent- and alcohol-proof throughout.

Case—Of hardwood, highly polished, provided with lock and key.

CHEMICAL MICROSCOPE "CHEM"—(Continued)

Code Word	Cat. No.	Objectives: Dry	Objectives: Oil Immersion	Huygenian Oculars with Cross-hairs	Range of Magnification	Condenser	With Revolving Dustproof Nosepiece	Price $	With Objective Clutch No. 5620 (*listed on page 20*) and	Price $
CEMAR	CHEM-A	**10X** (16mm) **30X** (6mm)	**None**	8X-12X	80-360X	None	**Double** No. 22602		**Two** Adapters No. 5621	
CEMBE	CHEM-B	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**None**	8X-12X	34-540X	None	**Triple** No. 22604		**Three** Adapters No. 5621	
CEMGI	CHEM-C	**10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30 (Achromatic)	6X-10X	60-1000X	Two-lens N.A. 1.20	**Triple** No. 22604		**Three** Adapters No. 5621	
CEMHY	CHEM-D	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**100X** (1.8mm) N.A. 1.30 (Achromatic)	6X-10X	26-1000X	Two-lens N.A. 1.20	**Quadruple** No. 22606		**Four** Adapters No. 5621	
CEMIF	CHEM-E	**4.3X** (32mm) **10X** (16mm) **45X**† (4mm)	**95X** (1.95mm) N.A. 1.32 (Fluorite)	6X-10X	26-950X	Two-lens N.A. 1.20	**Quadruple** No. 22606		**Four** Adapters No. 5621	
CEMFA	CHEM-O	**Chemical Microscope "CHEM"**, as described, complete, but **without** condenser, **without** objectives or oculars, **without** nosepiece or objective clutch and adapters..								
POLLS	28029	**Auxiliary Stage,** for use in metallurgical work, fitting substage of microscope "CHEM" for focusing metal specimens through means of the rack and pinion substage.....								
ILALU	22482	**Two-Lens Condenser,** N.A. 1.20, **with** iris diaphragm, for use in transmitted light, fitting substage of microscope "CHEM".....								

* *When ordering these equipments with objective clutch,* **add "CLUTCH"** *to code word.*

† With long working distance.

Note: 1) Equipments "CHEM-A"–"CHEM-D" include objectives for examination in transmitted light.

2) For use with the microscope "CHEM," dependent upon its mode of application, the following accessories are recommended:

A) Large vertical illuminator No. 22550 (listed on page 172), *OR* Simplified vertical illuminator No. 22556 (listed on page 173). } (*for the examination of opaque objects—metal specimens, etc.*)

B) Convertible microscope lamp No. 22580 (listed on page 166), *OR* Special lamp No. 22583a (listed on page 166). } (*for use with above opaque illuminators*)

C) Microscope objectives, specially corrected for the examination of opaque objects (listed on page 125),

D) Leitz special microscope lamp No. 32800 (listed on page 162), (*for general trans-illumination in connection with microscope "CHEM"*)

E) Compound mechanical stage No. 22614 (listed on page 171), (*recommended for use with microscope "CHEM" when applied to general biological and chemical examinations*)

F) Compound mechanical stage No. 2230 (listed on page 115), (*recommended for use with microscope "CHEM" when applied to mineralogical—polarizing—examinations*)

G) Microscope objectives, for use with microscope "CHEM" in polarized light (listed on page 113),

H) Microscope oculars with crosshairs, for use with microscope "CHEM" (listed on page 113),

I) Suitable darkfield illuminators for use with microscope "CHEM" (listed on pages 26-30),

J) Micrometer measuring devices for use with microscope "CHEM" (listed on pages 174-176).

3) **If different equipments than those listed above are required, take as basis "CHEM-O" and add any such objectives, oculars and accessories as may be desired.**

PETROGRAPHICAL MICROSCOPES

On pages 102 to 111 we list an assortment of Leitz

Polarizing Microscopes

and those accessories most frequently used. For a complete listing and description of the entire line of these apparatus, we refer to

CATALOG III-B

copy of which we forward upon request without charge.

Leitz Petrographical Microscopes do not require any special introduction since they **have been adopted as standard for those laboratories in which highest efficiency of the microscopical study of minerals is of paramount consideration.** The construction of the Leitz Petrographical Microscopes has continuously been enhanced with new developments in the petrographical field and this through close cooperation with eminent authorities.

Dr. M. Berek, member of the Leitz research staff and who through his many articles on related subjects is undoubtedly known to most petrographists, uses his continued efforts to introduce new accessories invaluable for petrographic studies.

All optical units supplied with the Leitz Petrographical Microscopes are especially prepared and selected to be free from strain and consequently to be free from polarization effects. The complete line of Leitz Petrographical Microscopes with the exception of stand "III M" is provided with large tubes **making use of oculars of wide diameter.** These oculars cover an exceedingly large field and such an innovation is of eminent importance for petrographical examination for reasons that **the field covers an area approximately 50%** larger than microscopes of other manufacture.

Microscope Stand—Except for some characteristic mechanical and optical details, the general construction is similar to biological microscopes.

Illuminating Apparatus—The size of the polarizing prisms necessitates the use of relatively smaller condensers than those with which the biological microscopes are equipped. The optical units are mounted in such manner as to permit disengaging the upper portion of the condenser and this is accomplished by the turn of a separate lever. Such a construction affords a quick change of the condenser from conoscopic to orthoscopic observation or vice versa. The aperture of the illuminating pencil is regulated in a similar manner as with the biological microscope either by lowering the illuminating apparatus by means of the rack and pinion mechanism or by varying the aperture of the iris diaphragm mounted between the lens components of the condenser. The mirror of the illuminating apparatus has concave and plano surfaces and is provided with universal movement. (*The various models of illuminating apparatus are listed on page 114.*)

Object Stage—Is of rotatable pattern so as to afford a convenient means of changing the position of the object with respect to the plane of the polarizing prism. The amount of the rotation is read off a graduated circle with vernier.

Objectives—Those used with petrographical microscopes are identical to those employed for biological investigations except that they are especially prepared and selected so as to be free from internal strain and consequently free from polarization effect. The large number of objectives which passes through the Leitz Works affords ample means of selecting those which are perfect in meeting the requirements for examination under polarized light. (*The complete series of objectives, free from polarization, is listed on page 113.*)

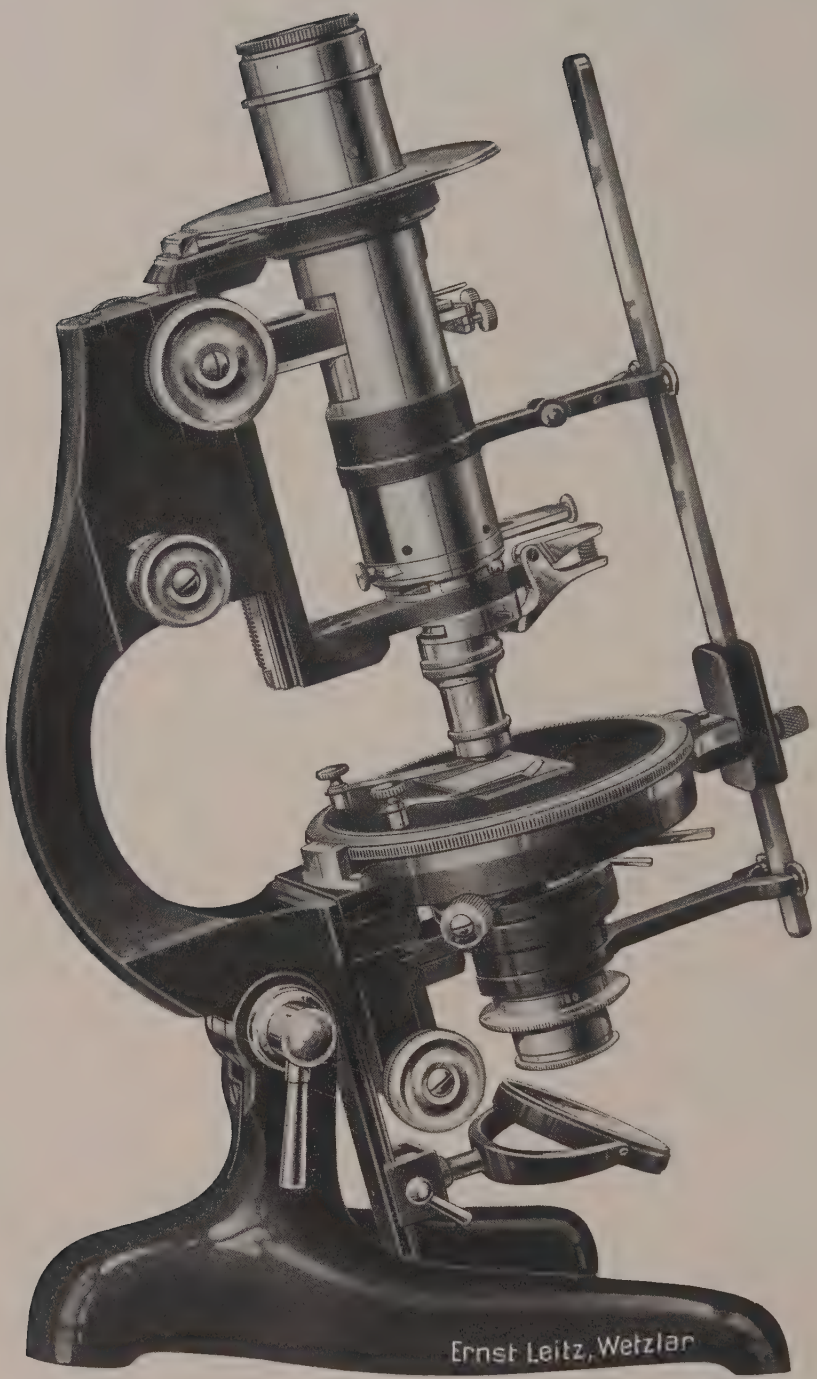
Objective Changing and Centering Device (Objective Clutch)—The rotary movement of the object stage necessitates a special centering device for the objectives. With the new and patented objective clutch supplied with Leitz Petrographical Microscopes, individual objective adapters are furnished, each adapter provided with centering screws, and it thus follows that each objective is centered independently from the other so that when attached to the objective clutch, it is and remains in a centered condition—a feature which microscopes of other manufacture do not provide. (*The objective clutch is listed on page 20.*)

Cap Nicol (Top Analyzer)—Aside from the tube analyzer (described below), we likewise supply a cap nicol for special modes of investigation.

Tube Analyzer—Is not subject to dioptric restrictions. When interposing the nicol prism of the tube analyzer into the image forming rays, a refocus of the objective would normally be required. To obviate this, a correction lens has been inserted into the mounting of the tube analyzer, on top of the nicol. Such a lens completely overcomes all those retarding effects which otherwise would cause an unfavorable influence upon the microscope image.

"Amici-Bertrand" **Auxiliary Lens**—Is provided for conoscopic observation (observation of interference figures). In the more elaborately equipped microscopes, the auxiliary lens can be made to focus within the tube by sliding it or by means of rack and pinion. The larger models likewise have an iris diaphragm attached to the *"Bertrand"* lens.

Oculars—Are of standard type; however, for petrographical examination equipped with crosslines, the eye lens being focusable. (*The complete series of these oculars is listed on page 113.*)



PETROGRAPHICAL MICROSCOPE "SM"
with Synchronic Rotation of Nicol Prisms

PETROGRAPHICAL MICROSCOPE "SM"

(Wide Tube for Oculars of Large Diameter)

In view of the fact that an arrangement providing the simultaneous rotation of the nicols, if attached to a standard petrographical microscope, would not prove entirely satisfactory, the special microscope "SM" has been constructed and in connection with it the feature of synchronic rotation of the nicols has been developed in a most perfect manner.

The special characteristics of model "SM" are that polarizer and analyzer can likewise be independently rotated through 240°. The rotation can be read off within 0.1° either from the scale on the object stage or from the scale on the tube. **During synchronic rotation of the nicols, the tube analyzer, and *"Bertrand"* lens, as well as the compensators may be inserted or removed at any position of the rotation.** The ocular crosshairs remain at all times, even during synchronic rotation of the nicols, oriented parallel to the vibration directions of the nicol prisms.

On account of the accuracy with which the rotation of the analyzer may be read, microscope "SM" can be used successfully for micro-polarimetric work. This instrument is especially recommended for the *"Federow"* method.

Object Stage—Of rotary pattern; the periphery of the stage is furnished with scale and double vernier permitting readings within 0.1°; the stage is furthermore equipped with a removable ring plate and may be clamped in position at any desired orientation; two stage clips are furnished.

Micrometer Screw—Of patented design, making use of ball bearings at the sliding surfaces whereby lost motion is eliminated completely and the mechanism acts entirely independently of lubrication; one head of the micrometer screw is equipped with divided drum for depth measurements and since one interval at the drum equals 0.001mm, measurements are possible within this minute ratio.

Coarse Adjustment—By rack and pinion.

Tube Analyzer—Anastigmatic type with *"Ahrens"* prism.

***"Amici-Bertrand"* Lens**—In centering mount with iris diaphragm, attached to slider, after F. E. Wright, adjustable by hand.

Cap Analyzer Support—Serving as socket for the top analyzer to rest on, provided with index line.

Ocular Adapter—To permit the use of oculars and tube accessories of small diameter.

Objective Clutch Changer—Of new and patented design for objectives; objectives remain individually and permanently centered.

Three Objective Adapters—Are included.

Illuminating Apparatus—Two-iris-diaphragm type, model "a" with *"Ahrens"* prism and five-lens condenser No. 2000 (*listed on page 114*).

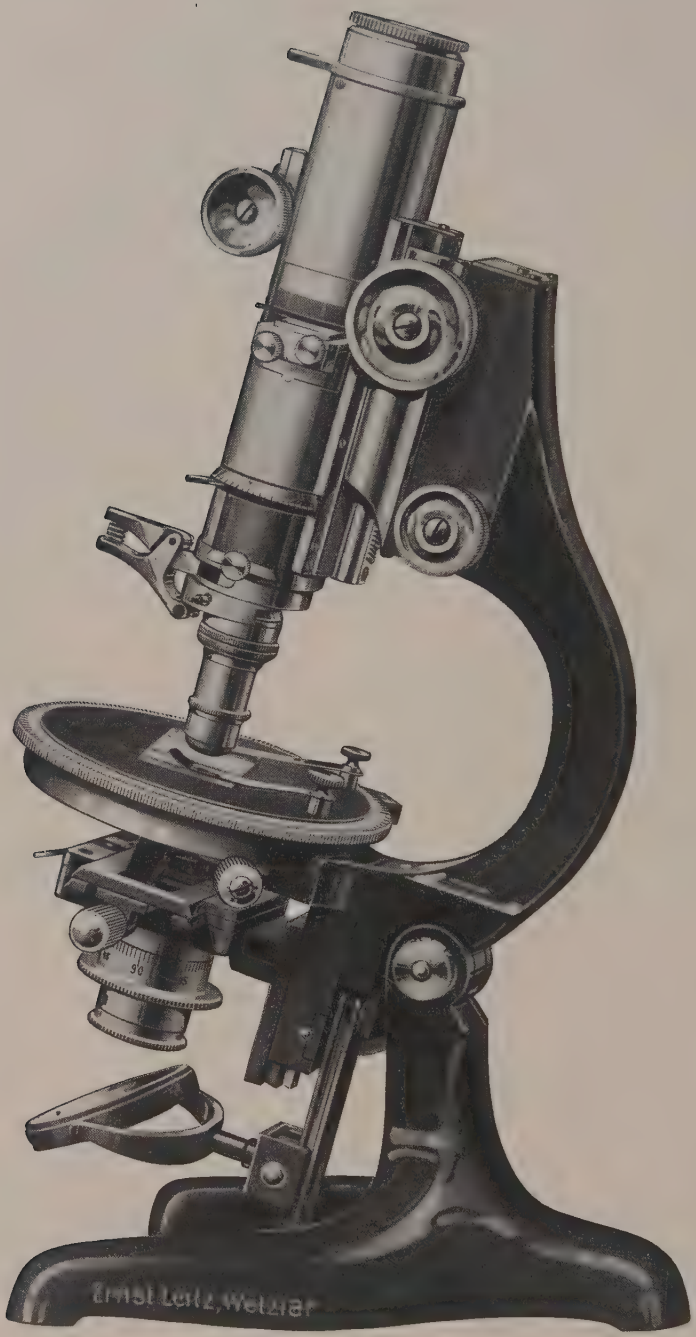
Cabinet—Mahogany wood, with lock and key.

Note: *For different types of illuminating apparatus, we refer to page 114.*

Code Word	Cat. No.	Designation	Price
BBSMO	**SM-0**	**Petrographical Microscope "SM"**, with synchronic rotation of the nicols, as described, **without** optical equipment.....	$
BBSTU	**SM-20**	**Petrographical Microscope "SM"**, with synchronic rotation of the nicols, as described, with optical equipment No. **20***.....	
BBSHE	**SM-30**	**Petrographical Microscope "SM"**, with synchronic rotation of the nicols, as described, with optical equipment No. **30***.....	
BBCAP	**2186**	**Cap Nicol** (top analyzer), with flange graduated in millimeters.....	

* *These optical equipments are itemized on page 112.*

Note: If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 113*), oculars (*listed on page 113*), and accessories (*listed on pages 115-116*). **Add** this equipment to **"SM-O."**



PETROGRAPHICAL MICROSCOPE "CM"

PETROGRAPHICAL MICROSCOPE "CM"

(Wide Tube for Oculars of Large Diameter)

Object Stage—Of rotary pattern; the periphery of the stage is furnished with scale and double vernier permitting readings within 0.1°; the stage is furthermore equipped with a removable ring plate and may be clamped in position at any desired orientation; two stage clips are furnished.

Micrometer Screw—Of patented design, making use of ball bearings at the sliding surfaces whereby lost motion is eliminated completely and the mechanism acts entirely independently of lubrication; one head of the micrometer screw is equipped with divided drum for depth measurements and since one interval at the drum equals 0.002mm, measurements are possible within this minute ratio.

Coarse Adjustment—By rack and pinion.

Tube Analyzer—Anastigmatic type with *"Ahrens"* prism.

"Amici-Bertrand" **Lens**—In centering mount with iris diaphragm, attached to slider, after F. E. Wright, adjustable by rack and pinion.

Cap Analyzer Support—Serving as socket for the top analyzer to rest on, provided with index line.

Ocular Adapter—To permit the use of oculars and tube accessories of small diameter.

Objective Clutch Changer—Of new and patented design for objectives; objectives remain individually and permanently centered.

Three Objective Adapters—Are included.

Illuminating Apparatus—Two-iris-diaphragm type, model "a" with *"Ahrens"* prism and five-lens condenser No. 2000 (*listed on page 114*).

Cabinet—Mahogany wood, with lock and key.

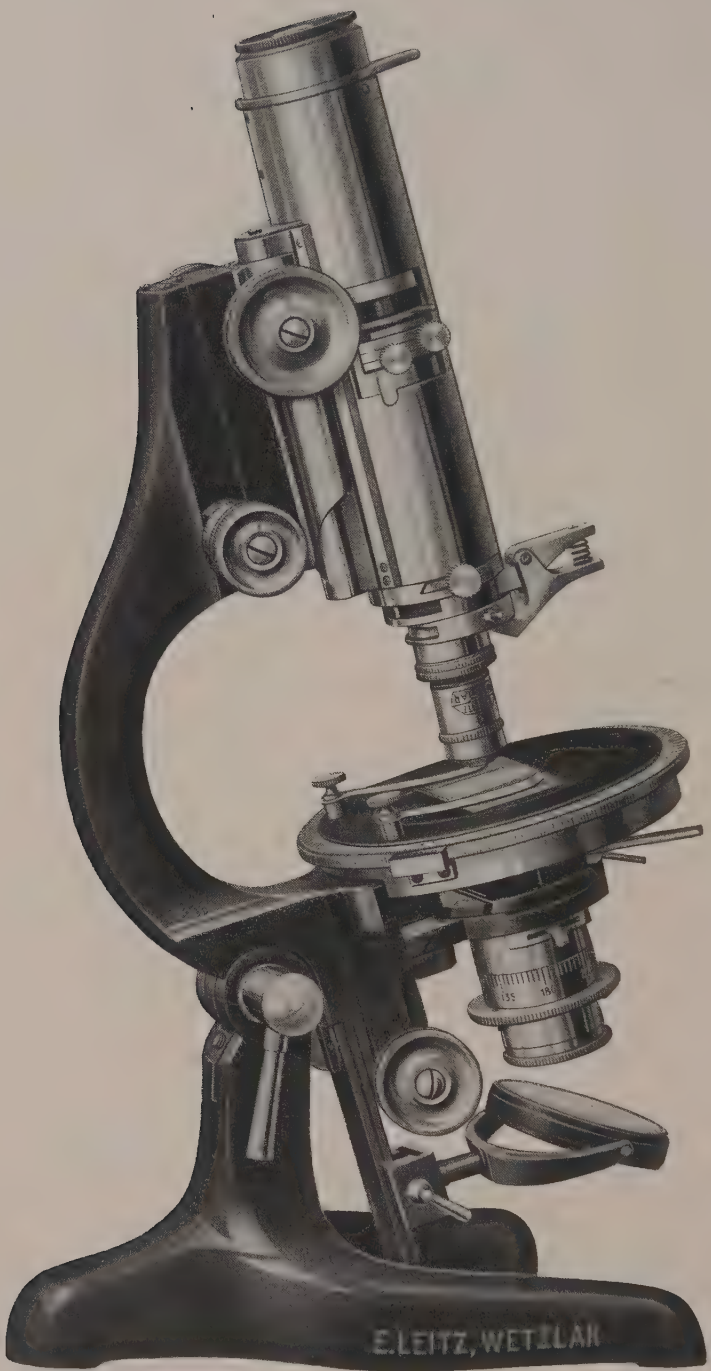
Note: *For different types of illuminating apparatus, we refer to page 114.*

Code Word	Cat. No.	Designation	Price
BBCMA	**CM-0**	**Petrographical Microscope "CM"**, as described, **without** optical equipment	$
BBCWO	**CM-20**	**Petrographical Microscope "CM"**, as described, with optical equipment No. **20***	
BBCRE	**CM-30**	**Petrographical Microscope "CM"**, as described, with optical equipment No. **30***	
CONAA		If Microscope "CM" is desired with illuminating apparatus "aa" No. 1999 (*listed on page 114*) in place of model "a" No. 2000, to the prices of above equipments, **add**	
BBCAP	**2186**	**Cap Nicol** (top analyzer), with flange graduated in millimeters	

* *These optical equipments are itemized on page 112.*

Note: If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 113*), oculars (*listed on page 113*), and accessories (*listed on pages 115-116*).

Add this equipment to **"CM-O."**



PETROGRAPHICAL MICROSCOPE "GM"

PETROGRAPHICAL MICROSCOPE "GM"

(Wide Tube for Oculars of Large Diameter)

Object Stage—Of rotary pattern; the periphery of the stage is furnished with scale and double vernier permitting readings within 0.1°; two stage clips are furnished.

Micrometer Screw—Of patented design, making use of ball bearings at the sliding surfaces whereby lost motion is eliminated completely and the mechanism acts entirely independently of lubrication; one head of the micrometer screw is equipped with divided drum for depth measurements and since one interval at the drum equals 0.002mm, measurements are possible within this minute ratio.

Coarse Adjustment—By rack and pinion.

Tube Analyzer—Anastigmatic type with *"Ahrens"* prism.

"Amici-Bertrand" **Lens**—In centering mount with iris diaphragm, attached to slider, after F. E. Wright, adjustable by hand.

Cap Analyzer Support—Serving as socket for the top analyzer to rest on, provided with index line.

Ocular Adapter—To permit the use of oculars and tube accessories of small diameter.

Objective Clutch Changer—Of new and patented design for objectives; objectives remain individually and permanently centered.

Three Objective Adapters—Are included.

Illuminating Apparatus—One-diaphragm type, model "b," with *"Glan-Thomson"* prism and three-lens condenser, No. 2002 (*listed on page 114*).

Iris Diaphragm—Attachable to the lower rim of the polarizer mounting, No. 2009.

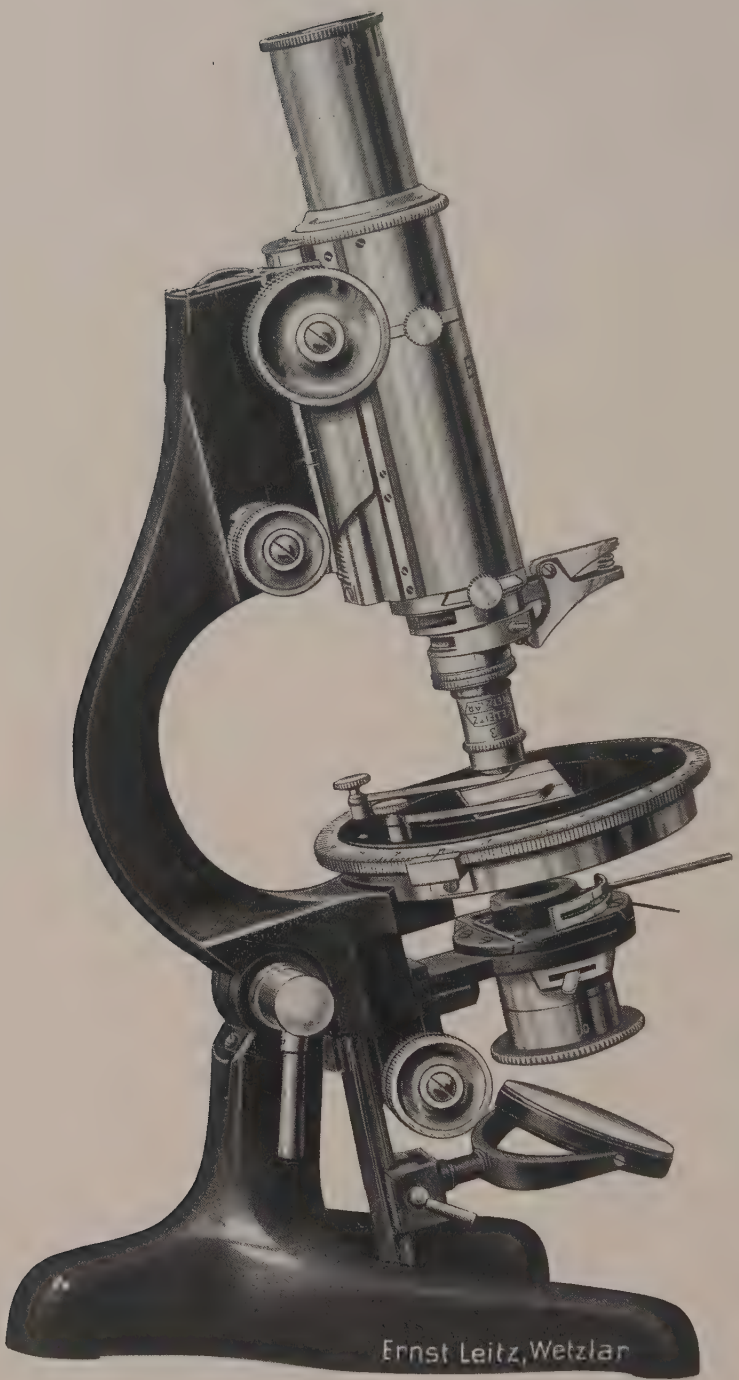
Cabinet—Mahogany wood, with lock and key.

Note: *For different types of illuminating apparatus, we refer to page 114.*

Code Word	Cat. No.	Designation	Price
			$
BBGOM	**GM-0**	**Petrographical Microscope "GM"**, as described, **without** optical equipment	
BBGAW	**GM-20**	**Petrographical Microscope "GM"**, as described, with optical equipment No. **20***	
BBGRO	**GM-30**	**Petrographical Microscope "GM"**, as described, with optical equipment No. **30***	
BBGUF	**GM-40**	**Petrographical Microscope "GM"**, as described, with optical equipment No. **40***	
BBCAP	**2186**	**Cap Nicol** (top analyzer), with flange graduated in millimeters	
BBGLA	**2081**	**Stage Clamping Device,** by means of which the stage may be clamped in position at any desired point of orientation	

* *These optical equipments are itemized on page 112.*

Note: If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 113*), oculars (*listed on page 113*), and accessories (*listed on pages 115-116*). **Add** this equipment to **"GM-O."**



PETROGRAPHICAL MICROSCOPE "KM"

PETROGRAPHICAL MICROSCOPE "KM"

(Wide Tube for Oculars of Large Diameter)

Object Stage—Of rotary pattern; the periphery of the stage is furnished with scale and double vernier permitting readings within 0.1°; two stage clips are furnished.

Micrometer Screw—Of patented design, making use of ball bearings at the sliding surfaces whereby lost motion is eliminated completely and the mechanism acts entirely independently of lubrication; one head of the micrometer screw is equipped with divided drum for depth measurements and since one interval at the drum equals 0.002mm, measurements are possible within this minute ratio.

Coarse Adjustment—By rack and pinion.

Tube Analyzer—Anastigmatic type with *"Ahrens"* prism.

"Amici-Bertrand" **Lens**—In permanent mounting attached to slider.

Ocular Adapter—To permit the use of oculars and tube accessories of small diameter.

Objective Clutch Changer—Of new and patented design for objectives; objectives remain individually and permanently centered.

Three Objective Adapters—Are included.

Ocular Diaphragm—No. 2062.

Illuminating Apparatus—Model "c" with *"Nicol"* prism and three-lens condenser permanently attached to polarizer, No. 2004 (*listed on page 114*).

Iris Diaphragm—Attachable to the lower rim of the polarizer mounting, No. 2009.

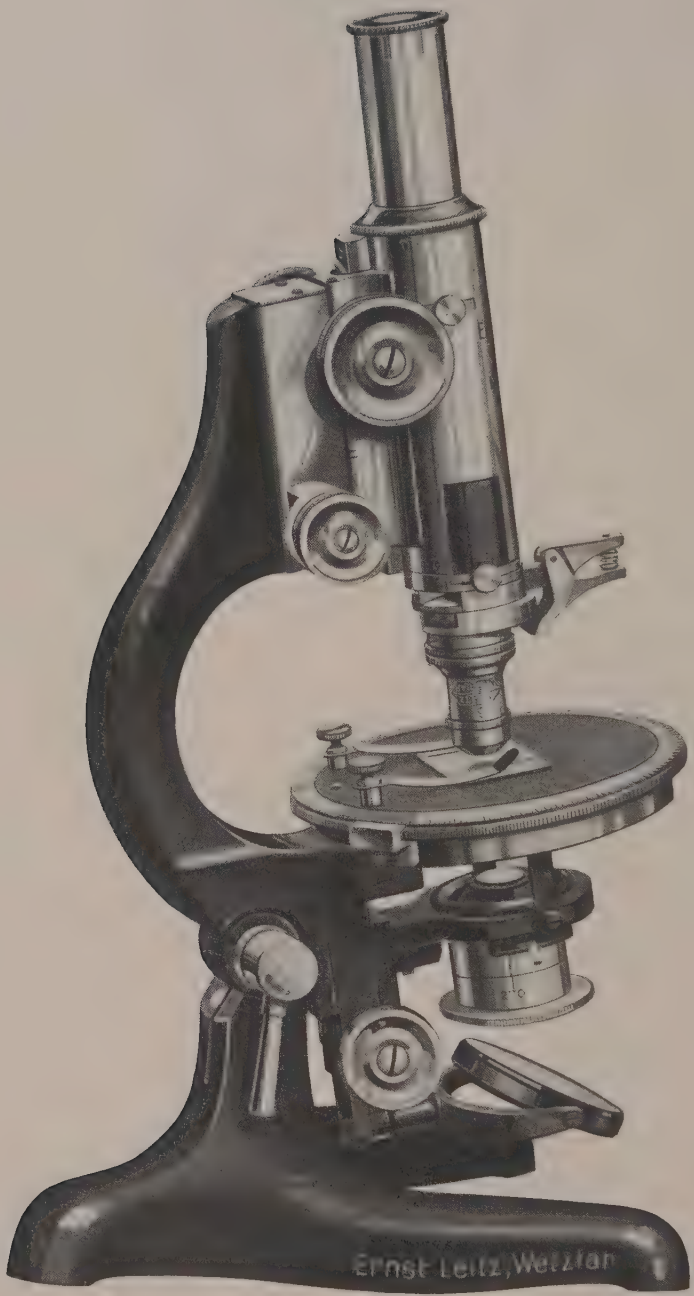
Cabinet—Hardwood, highly polished, with lock and key.

Note: *For different types of illuminating apparatus, we refer to page 114.*

Code Word	Cat. No.	Designation	Price
BBKMI	**KM-0**	**Petrographical Microscope "KM",** as described, **without** optical equipment	$
BBKIW	**KM-30**	**Petrographical Microscope "KM",** as described, with optical equipment No. **30***	
BBKEM	**KM-40**	**Petrographical Microscope "KM",** as described, with optical equipment No. **40***	
BBCAP	**2186**	**Cap Nicol,** with flange graduated in millimeters	
BBSUP	**2187**	**Supporting Flange** for cap nicol	
BBGLA	**2081**	**Stage Clamping Device,** by means of which the stage may be clamped in position at any desired point of orientation	

* *These optical equipments are itemized on page 112.*

Note: If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 113*), oculars (*listed on page 113*), and accessories (*listed on pages 115-116*). **Add** this equipment to **"KM-0."**



PETROGRAPHICAL MICROSCOPE "III M"

PETROGRAPHICAL MICROSCOPE "III M"

(With Tube for Oculars of Standard Diameter)

Object Stage—Of rotary pattern; the periphery of the stage is furnished with scale and double vernier permitting readings within 0.1°; two stage clips are furnished.

Micrometer Screw—Of patented design, making use of ball bearings at the sliding surfaces whereby lost motion is eliminated completely and the mechanism acts entirely independently of lubrication; one head of the micrometer screw is equipped with divided drum for depth measurements and since one interval at the drum equals 0.002mm, measurements are possible within this minute ratio.

Coarse Adjustment—By rack and pinion.

Tube Analyzer—With correction lens to compensate for the difference in focus.

"Amici-Bertrand" **Lens**—In permanent mounting attached to slider.

Objective Clutch Changer—Of new and patented design for objectives; objectives remain individually and permanently centered.

Three Objective Adapters—Are included.

Ocular Diaphragm—No. 2062.

Illuminating Apparatus—Model "c" with *"Nicol"* prism and three-lens condenser permanently attached to polarizer, No. 2004 (*listed on page 114*).

Cabinet—Hardwood, highly polished, with lock and key.

Note: *For different types of illuminating apparatus, we refer to page 114.*

Code Word	Cat. No.	Designation	Price
BBTAS	**III M-0**	**Petrographical Microscope "III M"**, as described, **without** optical equipment	$
BBTIL	**III M-30**	**Petrographical Microscope "III M"**, as described, with optical equipment No. **30***	
BBTRM	**III M-40**	**Petrographical Microscope "III M"**, as described, with optical equipment No. **40***	
BBCAP	**2186**	**Cap Nicol**, with flange graduated in millimeters	
BBSUP	**2187**	**Supporting Flange** for cap nicol	

* *These optical equipments are itemized on page 112.*

Note: If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 113*), oculars (*listed on page 113*), and accessories (*listed on pages 115-116*). **Add this equipment to "III M-0."**

AS AID in the SELECTION OF STANDARD EQUIPMENTS FOR POLARIZING MICROSCOPES WE OFFER the FOLLOWING LISTS:

Equipment No. 20:

No. 22002a	**Achromatic Objective** 3.2X (40 mm), N.A. 0.12	free from polarization
No. 22008a	**Achromatic Objective** 10X (16 mm), N.A. 0.25	
No. 22016a	**Achromatic Objective** 45X (4 mm), N.A. 0.85	
No. 22022a	**Achromatic Oil Immersion Objective** 100X (1.8mm), N.A. 1.30	
No. 22023	**Achromatic Oil Immersion Objective** 100X (1.8mm), N.A. 1.45, for interference figure observation (*not available for orthoscopic observation*)	
No. 2236	**Two** Additional **Objective Adapters**	
No. 2007	**Immersion Condenser** N.A. 1.45, for use with oil immersion objective No. 22023	
No. 22041	*"Huyghenian"* **Ocular** 5X with adjustable eyelens and crosswebs	large diameter
No. 22045	*"Huyghenian"* **Ocular** 8X with adjustable eyelens and crosswebs	
No. 22047	*"Huyghenian"* **Ocular** 10X with adjustable eyelens and crosswebs	
No. 2209	*"Huyghenian"* **Ocular** 6X with adjustable eyelens and micrometer 10mm divided in 100 parts	
No. 2208	**Ocular Net Micrometer** for ocular 6X	
No. 2206	**Object Micrometer** 2mm divided in 200 parts	
No. 2023	**Selenite Plate,** red, 1. order, in mounting	
No. 2024	**Mica Plate,** ¼γ, in mounting	
No. 2021	**Combination Wedge,** *"Johannsen,"* in mounting	
No. 2020	**Compensator,** *"Berek,"* in mounting	
No. 2230	**Compound Mechanical Stage**	
No. 36060	**Total Equipment No. 20:** $_____	
	Code Word: PUTAW	

Equipment No. 30:

No. 22002a	**Achromatic Objective** 3.2X (40mm), N.A. 0.12	free from polarization
No. 22008a	**Achromatic Objective** 10X (16mm), N.A. 0.25	
No. 22016a	**Achromatic Objective** 45X (4mm), N.A. 0.85	
No. 22041	*"Huyghenian"* **Ocular** 5X with adjustable eyelens and crosswebs	large diameter
No. 22045	*"Huyghenian"* **Ocular** 8X with adjustable eyelens and crosswebs	
No. 2209	*"Huyghenian"* **Ocular** 6X with adjustable eyelens and micrometer 10mm divided in 100 parts	
No. 2208	**Ocular Net Micrometer** for ocular 6X	
No. 2206	**Object Micrometer** 2mm divided in 200 parts	
No. 2023	**Selenite Plate,** red, 1. order, in mounting	
No. 2024	**Mica Plate,** ¼γ, in mounting	
No. 2021	**Combination Wedge,** *"Johannsen,"* in mounting	
No. 36062	**Total Equipment No. 30:** $_____	
	Code Word: PUTBE	

Equipment No. 40:

No. 22008a	**Achromatic Objective** 10X (16mm), N.A. 0.25	free from polarization
No. 22016a	**Achromatic Objective** 45X (4mm), N.A. 0.85	
No. 22041	*"Huyghenian"* **Ocular** 5X with adjustable eyelens and crosswebs	large diameter
No. 22045	*"Huyghenian"* **Ocular** 8X with adjustable eyelens and crosswebs	
No. 2023	**Selenite Plate,** red, 1. order, in mounting	
No. 2024	**Mica Plate,** ¼γ, in mounting	
No. 2022	**Quartz Wedge,** 1.-4. order, in mounting	
No. 36064	**Total Equipment No. 40:** $_____	
	Code Word: PUTCH	

Note: *The individual items of the above equipments are found listed and described on pages 113-116.*

ACHROMATIC OBJECTIVES

(Free from Polarization)

Optical Data and Prices

Code Word	Cat. No.	Magn. No.	Equivalent Focal Length mm	Type of Objective	Old Designation No.	N.A.	Working Distance mm	Micrometer Value [1] with Ocular 6X mm	Price
PETTA	**22002a**	**3.2X**	**40**	Dry	1	**0.12**	34.5	0.049	$
PUTDA	**22005b**	**4.3X**	**32**	Dry	1b	**0.15**	27	0.037	
PETME	**22006b**	**6 X**	**24**	Dry	2	**0.20**	16	0.0275	
PETRI	**22008a**	**10 X**	**16**	Dry	3	**0.25**	5.8	0.0156	
PETKU	**22012a**	**20 X**	**9**	Dry	4	**0.45**	2.0	0.008	
PETVY	**22014a**	**30 X**	**6**	Dry	5	**0.65**	0.75	0.005	
PETEX	**22016a**	**45 X**	**4**	Dry	6	**0.85**	0.32	0.0036	
PETIS	**22018a**	**62 X**	**3**	Dry	7	**0.85**	0.28	0.0025	
PEWAT	**22020a**	**90 X**	**2.1**	Water Im.	10	**1.20**	0.10	0.0018	
PELIM	**22022a**	**100 X**	**1.8**	Oil Im.	1/12	**1.30**	0.11	0.0016	
PEDAX	**22023**	**100 X**	**1.8**	Oil Im.	1/12Sp.	**1.45**	0.15	0.0016	

[1]) Value on the stage of 0.1mm in the focal plane of the ocular.

"HUYGHENIAN" OCULARS

(With Adjustable Eye Lens and Crosswebs)

Optical Data and Prices

Code Word		Cat. No.		Magn. No.	Equivalent Focal Length mm	Old Designation No.	Price	
Large Diam.	Standard (**Small**) Diam.	**Large** Diam.	Standard (**Small**) Diam.				**Large** Diam.	Standard (**Small**) Diam.
PACEF	PACBY	**22039**	**22919**	**4X**	62.5	0	$	$
PACIG	PACPE	**22041**	**22920**	**5X**	50.0	I		
PUTEB	PACCK	**22043**	**22921**	**6X**	41.65	II		
PACOX	PACRA	**22045**	**22922**	**8X**	31.25	III		
PUTFI	PACSO	**22047**	**22924**	**10X**	25.0	IV		
Supplied in Standard Diameter only	PACDN	Supplied in Standard Diameter only	**22925**	**12X**	20.85	V	Supplied in Standard Diameter only	

Note: In multiplying the magnification number of the objective with the magnification number of the ocular, one derives at the combined magnifying power of the objectives and oculars used.

ILLUMINATING APPARATUS FOR PETROGRAPHICAL MICROSCOPES

In order that the petrographical microscopes may serve their intended purpose to best advantage, it has been found advisable to construct special illuminating apparatus. For the Leitz petrographical microscopes, four different forms of illuminating apparatus are available. Each model is provided immediately above the polarizer with a lens component with illuminating aperture of approximately 0.22 intended for use with low power objectives. This component is likewise available for use with the *"Federow"* method without requiring any particular change in the illuminating apparatus. To obtain illuminating pencils of larger aperture, another condenser unit in swing-out mounting is provided which suffices for the aperture of all objectives of a numerical aperture up to 1.0. This condenser unit is screwed into a swinging device so arranged that even in the highest position of the illuminating apparatus, it may be readily swung in or out by the simple motion of a lever knob. For use with objectives having apertures exceeding 1.0, an interchangeable immersion condenser is supplied. When this is used with cedarwood oil as immersion fluid, it furnishes a numerical aperture of 1.45 provided that the thickness of the object slide is kept within the limits of 0.9 to 1mm. The polarizer together with its mount can be rotated within the sleeve of the illuminating apparatus and withdrawn from it. The illuminating apparatus as a whole may be raised and lowered by rack and pinion.

With the illuminating apparatus models "aa," "a" and "b," the entire lens combination is mounted on a transverse slide by means of which it may be removed and replaced by other illuminators.

Polarizing Illuminating Apparatus "aa" with *Two-Diaphragm Condenser*—Is composed of five lenses and has a higher degree of correction than those models designated under "b" and "c." The advantage of this higher degree of correction is particularly noticeable in photo-micrography when the illumination is furnished through artificial sources of small area. The entire system of lenses is contained in a slide fitting secured by a clamping screw and may be withdrawn at will. The polarizer consists of an *"Ahrens"* prism having a cross section of 13 x 13mm. **The polarizer with mounting is attached to a slider by means of which it may be readily withdrawn sideways from the illuminating apparatus.** The iris diaphragm situated between the two condenser units acts as an aperture stop when the entire condenser is in operation and corresponds to the iris diaphragm in the *"Abbe"* illuminating apparatus. The iris diaphragm mounted below the polarizer operates as an aperture stop when, as is necessary with low power objectives, the swing-out component has been swung aside.

Polarizing Illuminating Apparatus "a" with *Two-Diaphragm Condenser*—Corresponds in its construction to the model "aa" with the only difference that the polarizer is mounted in a sleeve fitting instead of a slider, as is the case in model "aa."

Polarizing Illuminating Apparatus "b"—Is composed of three lenses held in a slide fitting with clamping screw. This illuminating apparatus is supplied with an iris diaphragm conforming to that of the *"Abbe"* illuminating apparatus. The lever knob serves to shift the swing-out component N.A. 1.0 in and out of operation.

Polarizing Illuminating Apparatus "c"—Is like model "b" composed of three lenses, the condenser units being permanently attached to the polarizer. A lever knob serves for operating the swing-out component of N.A. 1.0. This illuminating apparatus does not include an iris diaphragm.

Code Word	Cat. No.	Designation	Price
PUZAB	**1999**	**Illuminating Apparatus "aa",** as described, with **two**-diaphragm condenser and *"Ahrens"* prism. (*This illuminating apparatus cannot be used in connection with microscope "SM".*)	$
PUMAX	**2000**	**Illuminating Apparatus "a",** as described, with **two**-diaphragm condenser and *"Ahrens"* prism	
PUCOL	**2001**	**Illuminating Apparatus "b",** as described, with **one**-diaphragm condenser and *"Nicol"* prism	
PUGLA	**2002**	**Illuminating Apparatus "b",** as described, with *"Glan-Thomson"* prism	
PUHAR	**2003**	**Illuminating Apparatus "b",** as described, with *"Ahrens"* prism	
PUNIK	**2004**	**Illuminating Apparatus "c",** as described, with *"Nicol"* prism	
PUTOM	**2005**	**Illuminating Apparatus "c",** as described, with *"Glan-Thomson"* prism	
PURES	**2006**	**Illuminating Apparatus "c",** as described, with *"Ahrens"* prism **Note:** All polarizing prisms occasionally exhibit dark ramifications in the cemented surfaces. These indicate places where the cement has become loose and the spots are visible, since at these places the extraordinary ray is totally reflected within the Island Spar as well as the ordinary ray. Prisms which have thus deteriorated should be returned to us for recementing.	
PUKAP	**2007**	**Immersion Condenser N.A. 1.45,** interchangeable with the condenser of N.A. 1.0; attachable to any of the four models of illuminating apparatus, for use with objectives of numerical aperture exceeding 1.0	
PUBAK	**2008**	**Two-Lens Bacteriological Condenser,** *"Special Model,"* **N.A. 1.20,** adapted for use in the slide fitting of illuminating apparatus "aa", "a" and "b" for viewing inclusions, twin laminae, cleavage surfaces, etc., with objectives of low power (40-24mm)	
PUIRI	**2009**	**Iris Diaphragm,** for attaching to the lower rim of the polarizer mounting, for use with the illuminating apparatus "b" and "c"	

POPULAR ACCESSORIES FOR PETROGRAPHICAL MICROSCOPES

(For a complete assortment of these accessories, we refer to

CATALOG III-B)

Code Word	Cat. No.	Designation	Price
KOGIP	2023	**Selenite Plate,** red, 1. order, in metal mounting to fit tube slit	$
KOMER	2024	**Mica Plate,** ¼ λ, in metal mounting to fit tube slit	
KORAZ	2022	**Quartz Wedge,** 1.—4. order, in metal mounting to fit tube slit	
KOJAN	2021	**Quartz-Selenite Compensator** *"Johannsen,"* in metal mounting to fit tube slit; in this compensator, the quartz wedge surmounts a selenite plate of such thickness that at the edge of the wedge the resulting phase difference becomes zero; within the same mounting, however, separated from the wedge by vacant aperture, is provided a selenite plate producing red of the 1. order	
BEREK	2020	**Compensator** after *Dr. M. Berek,* in metal mounting to fit tube slit; this compensator is designed on the principle of the revolving *"Biot-Bravais"* compensator but it has a considerably extended range of measurement (four orders); a newly derived compensator formulae furnishes means of interpreting the results of the measurements in a very simple manner; the compensator is much more sensitive than the *"Babinet"* form with respect to small and intermediate phase differences; being, moreover, used in the tube slit above the objective, measurements can be made without the use of a top analyzer; the instrument is likewise adapted, in the place of selenite and mica plates, for the qualitative detection of small degrees of total refraction and it can be used with special advantage for determining optical characteristics; complete with table of logarithms, directions and calibration for three wave lengths and with respect to the conventional optical center of gravity of white light	
KOHIL	2060	**Aplanatic Auxiliary Magnifier** after *Dr. M. Berek,* with hinged fitting for attachment over the ocular (when employed in connection with oculars 6X and 8X, the magnifier 16X should be used, while with oculars 4X and 5X, the magnifier 12X is needed); *the auxiliary magnifier is used for viewing the conoscopic interference image of extremely small mineral grains*	
PIRIG	2110	**Ocular** after *Wright,* with iris diaphragm, slit insertion and flange for the analyzer, with index	
ANTOP	2111	**Top Analyzer** for ocular No. 2110 (to be ordered only when the equipment of the microscope does not already include a top analyzer)	
PITER	2112	**Auxiliary Lens,** *"Bertrand,"* adaptable to the *"Wright"* ocular No. 2110, interchangeable with the *"Bertrand"* lens of microscopes "SM", "CM" and "GM"	
PICRO	2113	**Ocular Micrometer** for ocular No. 2110, 10mm divided in 100 parts	
PINET	2114	**Ocular Crossline Micrometer** for ocular No. 2110, one square centimeter divided in 400 parts	
PIARZ	2115	**Quartz Wedge** for ocular No. 2110, 1.—4. order, in metal mounting	
PIORT	2116	**Quartz Wedge** for ocular No. 2110, 1.—4. order, with orientation ruling	
PIBIN	2117	**Combination Quartz Wedge** after *Wright,* for ocular No. 2110, with orientation ruling	
PIGUZ	2118	**Quartz-Selenite Compensator** after *Wright,* for ocular No. 2110	
PIJON	2119	**Quartz-Selenite Compensator** after *Johannsen,* for ocular No. 2110	
PIDOP	2120	**Quartz Double Wedge** after *Wright,* for ocular No. 2110	
PIGIM	2121	**Mica Echelon** after *Federow,* for ocular No. 2110	
PISOL	2122	**Double Plate** after *Soleil,* for ocular No. 2110	
PITRU	2123	**Quadruple Plate** after *Bertrand,* for ocular No. 2110	
KONAK	2124	**Half-Shadow Plate** after *Nakamura,* for ocular No. 2110	
KOLEP	2125	**Half-Shadow Wedge** after *Macé de Lépinay,* for ocular No. 2110	
KORIG	2126	**Half-Shadow Wedge Plate** after *Wright* (double quartz wedge plate), for ocular No. 2110 **Note:** *Nos. 2125 and 2126 have a variable half-shadow angle and usually preference is given to the arrangement after Macé de Lépinay.*	
PIRUX	2230	**Compound Mechanical Stage** which attaches by screw to the revolving stage of the petrographical microscopes; the transverse as well as the forward and backward motions have a range of 30mm, either movement reading by scale and vernier within 0.1mm; the object clamps are so arranged that they will hold object slides of different size	
PIZAN	2235	**Objective Clutch Changer,** patented form, for petrographical microscopes	
PIZUT	2236	**Centering Adapter** for objectives, for use with objective clutch changer No. 2235	
MIKUL	2209	**Micrometer Ocular, large** diameter, with movable eye lens and micrometer scale 10mm divided in 100 parts	
DECFO	22646	**Micrometer Ocular, standard** diameter, with movable eye-lens and micrometer 10mm divided in 100 parts (*suitable for petrographical microscope IIIM*)	
OKNET	2208	**Ocular Crossline Micrometer,** one square centimeter divided in 400 squares	
OBTER	2205	**Stage Micrometer,** engraved on glass, 1mm divided in 100 parts, for measuring the magnification and for valuating ocular micrometers, etc.	
OBMET	2206	**Stage Micrometer,** photographed scale, 2mm divided in 200 parts	

ACCESSORIES FOR THE UNIVERSAL REVOLVING STAGE METHODS AFTER *"FEDEROW"*

(Adapted for use with Universal Microscope "UNMIC," Microscopes "AABM," "SM," "CM," "GM," and "KM.")

Heretofore, the universal revolving stages designed for the application of the methods of *"Federow"* and *"Klein"* were only adapted for the use of small especially prepared specimens. In its new form, the Leitz universal stage is available for mineral sections mounted on object slides of standard size 28 x 48mm. The increased dimensions of this stage have rendered it possible to **greatly improve** the accuracy of the bearings for the various axis of rotation and it has also rendered it **easier to work** with the apparatus. In addition, the bearings of the axis of rotation are so arranged that the mineral section lies on the universal stage as it does on an ordinary microscope stage with the coverglass on top. The innermost stage plate is movable to suit the thickness of the object slide. The illumination apparatus of the Leitz microscopes are available for use with the universal revolving stage without these apparatus requiring any change.

The "Micro-Summars" 42, 35 and 24mm (listed on page 17), as well as the achromatic objectives **3.2X** (40mm) and **6X** (24mm) (listed on page 113), are available for use with the universal revolving stage. These objectives admit of use being made of the full range of rotation of which the stage is capable. The following magnifications are obtainable with the objectives mentioned:

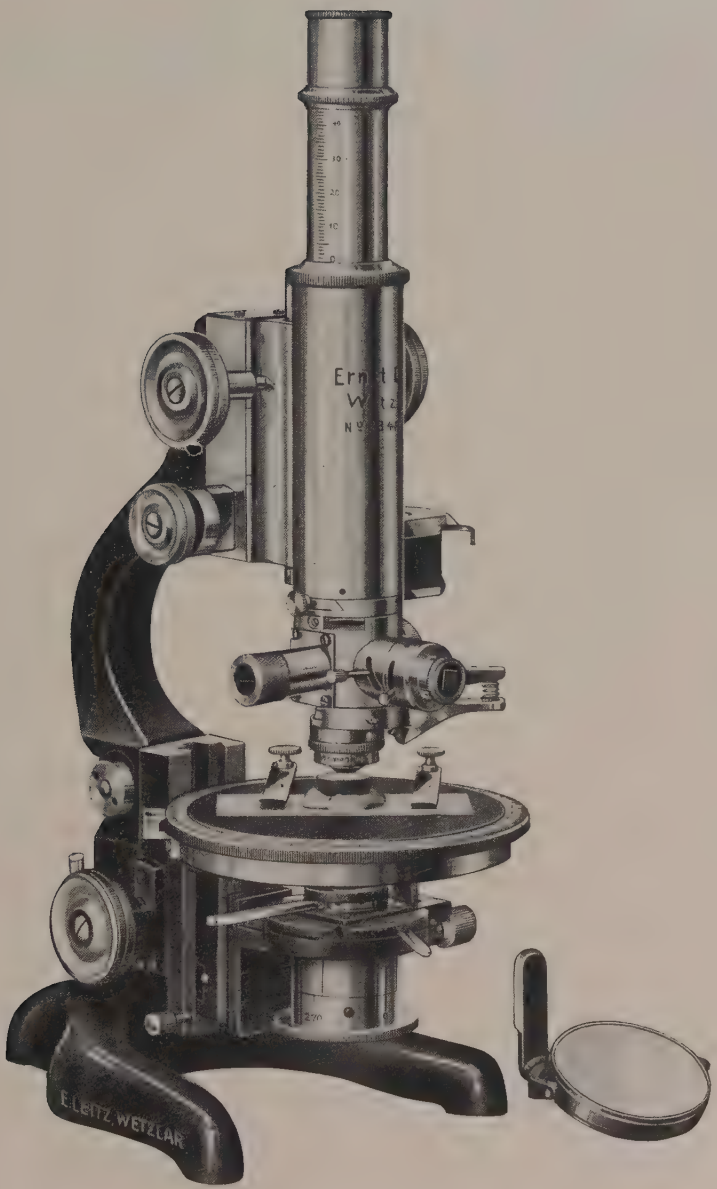
	"Huyghenian" Oculars		
	5X	**8X**	**12X**
"Micro-Summar" 42mm and Objective **3.2X** (40mm)	25	40	60
"Micro-Summar" 35mm	35	50	80
"Micro-Summar" 24mm and Objective **6X** (24mm)	45	70	100

The mineral section is best centered on the microscope stage without orientation-cross and with the section placed in position between the segments. An orientation-cross is only furnished upon special order.

The **manner of using** the universal rotating stage and its principle of application are fully explained by M. Berek in his paper "Mikroskopische Mineralbestimmung mit Hilfe der Universaldrehtischmethoden," 1924, *published by Gebrueder Borntraeger, Berlin.*

Code Word	Cat. No.	Designation	Price
RINGA	**2080**	**Ring Plate,** detachable, for the object stage, *for use with universal stage No. 2082*	$
RESTO	**2081**	**Clamp,** for arresting the rotation of the object stage, *for use with universal stage No. 2082*	
FEDOR	**2082**	**Universal Revolving Stage,** large model, with four rotary motions, two pairs of spherical segments (refractive indices 1.516 and 1.649), two clamping screws, **in case**	
FEGMA	**2082a**	**One Pair of Segments** with refractive index 1.516, *for use with universal stage No. 2082*	
FESEG	**2083**	**One Pair of Segments** with refractive index 1.554, *for use with universal stage No. 2082* (for the optical measurement of feldspar)	
FEGNO	**2083a**	**One Pair of Segments** with refractive index 1.649, *for use with universal stage No. 2082*	
		Note: *Segments of refractive indices other than those listed are furnished upon request. For the determination of the three principal refractive indices according to the method for double refraction on the uncovered surfaces, we offer accurate hemispheres which can be used in place of the segments Nos. 2082a and 2083a. These special segments are available in indices up to N = 1.92* (**Prices upon request.**	
FEKLE	**2084**	**Two Auxiliary Clamps,** for attaching mineral sections to the revolving stage No. 2082, when operating without the upper segment	
SUMEX	**2085**	**"Micro-Summar,"** 35mm, with iris diaphragm	
PINGE	**2087**	**Objective Centering Adapter** for "Micro-Summar" No. 2085	
BEREK	**2020**	**Compensator** after *Berek (listed on page 115)*	
NAGMI	**2089**	**Reading Magnifier,** 6X	
FEWUL	**2090**	**Stereographic Reticule** after *Wulff*, mounted on wood	
PIRIG	**2091**	**Ocular** after *Wright*, with iris diaphragm	
ANTOP	**2092**	**Top Analyzer,** for Ocular No. 2091	
KOLEP	**2093**	**Half-Shadow Wedge** after *Macé de Lépinay*, for Ocular No. 2091	
PIROK	**2094**	**Ocular** with iris diaphragm and adjustable eye lens (standard size)	
FEGFU	**2094a**	**Guiding Sledge** for systematic movement of the mineral section beneath the segment of the universal stage No. 2082, with micrometer scale	
FEGSE		**Note:** *The use of Guiding Sledge No. 2094a necessitates a slight change of the upper segment: charge for this change, per segment*	
FEGAN	**2094b**	**Adjustable Orientation Clamp** for the rotatable object stage	
		Note: *Items Nos. 2020 and 2092 may be omitted if they already form part of the equipment of the microscope.*	
		To those who attach value to being able to test the accuracy of the positions of the axis and that of the graduations, we recommend:	
PIGAU	**2097**	**Mirror Device** after *Gauss*, interchangeable with the tube analyzer, including coverglass with cross lines for attachment to the objective, for *"Federow's"* method of autocollimation	

Note: As an exceedingly suitable source of illumination for the universal revolving stage, we recommend the special low voltage lamp No. 32800 (*listed on page 162*).



POLARIZING MICROSCOPE "MOP"

for the Examination of **Opaque Ores under Polarized Light**

(*Continued on page 118*)

POLARIZING MICROSCOPE "MOP"

This microscope which has been designed in collaboration with Prof. Schneiderhoehn is primarily intended for the examination of crude ores having one surface ground plane and polished. It is, however, likewise available for every other kind of petrographical and metallurgical work. Microscope "MOP" is adapted for investigations under transmitted as well as reflected light. Both modes admit of the use of polarized light.

The stand is equipped with inclination joint. The coarse focus is effected by rack and pinion and the fine adjustment by micrometer screw. The object stage can be raised and lowered by rack and pinion motion. The stage is circular and provided at its periphery with scale and vernier. The objectives are interchanged and centered by means of the three-point objective clutch and centering adapters, the clutch being attached to a vertical illuminator in a stationary manner. For investigation in transmitted light, the microscope "MOP" may be supplied with the petrological illuminating apparatus, the latter being equipped with either a *"Nicol," "Glan-Thomson,"* or *"Ahrens"* prism as may be preferred. For investigation in reflected polarized light, a polarizer is provided which is inserted into the entrance tube of the vertical illuminator. The analyzer is mounted within the tube on a slide fitting and is of the anastigmatic type; it can be rotated within an angle of 90°. For the reception of compensators, the tube is provided with a slit. For use with microscope "MOP" a special set of objectives is furnished, all of which are corrected for a tube length of 215mm. These objectives are adjusted for examination of opaque objects and at the same time are free from polarization. During use, the microscope draw tube should be set to its zero mark. The special set of objectives which we recommend includes two low-power oil immersions, the importance of which for examination of opaque ores is well evident.

Code Word	Cat. No.	Designation	Price Unit	Price Total
MERZO	**MOP**	**Microscope "MOP",** as described, complete with anastigmatic tube analyzer on slide fitting; large vertical illuminator, equipped with total reflecting prism and reflecting glass plate, iris diaphragm and illuminating lens; objective clutch changer with three objective adapters; polarizer to fit entrance tube of vertical illuminator; object stage with rack and pinion for vertical motion and clamp by which to arrest the rotating motion; selenite plate, red, 1. order, in metal mounting; mica plate, 1/4 λ, in metal mounting; *"Huyghenian"* ocular 8X with adjustable eye lens and cross-webs, **in cabinet**	$	$
PIZIR	**2236a**	**Four Additional Objective Adapters** (*required for use with the set of objectives listed below*)		
		Optical Equipment I: For Investigation in Reflected Polarized Light, at a Tube Length of 215mm		
PUTDA	**22005b**	**Achromatic Objective**—*Dry*—**4.3X** (32mm), N.A. **0.15**		
PUTGY	**28111**	**Achromatic Objective**—*Dry*—**16X** (14mm), N.A. **0.40**		
PUTHX	**28201**	**Fluorite Objective**—*Dry*—**42X** (4.2mm), N.A. **0.85**		
PUTIL	**28106**	**Achromatic Objective**—*Oil Im.*—**10X** (16mm), N.A. **0.25**		
PUTJF	**28121**	**Achromatic Objective**—*Oil Im.*—**22X** (8mm), N.A. **0.65**		
PUTKM	**28221**	**Fluorite Objective**—*Oil Im.*—**54X** (3.45mm), N.A. **0.95**		
PUTLD	**28231**	**Fluorite Objective**—*Oil Im.*—**95X** (1.95mm), N.A. **1.32**		
DECFO	**22646**	**Micrometer Ocular 6X,** with adjustable eye lens and micrometer 10mm divided in 100 parts		
PEROT	**22069**	**"Periplan" Ocular 8X**		
PEZWO	**22073**	**"Periplan" Ocular 12X**		
MERSY	**36050**	**Total Optical Equipment I:**		
		In addition to those objectives listed under optical equipment I, we can likewise supply for the investigation in reflected polarized light, the following:		
PUTMO	**28226**	**Fluorite Objective**—*Oil Im.*— **70X** (2.6mm), N.A. **1.30**		
PUTNR	**28236**	**Fluorite Objective**—*Oil Im.*—**114X** (1.6mm), N.A. **1.32**		
PUTOV	**28286**	**Apochromatic Objective**—*Oil Im.*—**92X** (2mm), N.A. **1.32**		
		Optical Equipment II: For Investigation in Transmitted Polarized Light at a Tube Length of 215mm		
		Note: The entire series of objectives and oculars listed under optical equipment I and under Nos. 28226, 28236 and 28286, for **reflected** light, is likewise available for **transmitted** light investigations with the exception of the objective No. 28201, and in place of this, the following should be substituted:		
PUTPZ	**28126**	**Achromatic Objective**—*Dry*—**30X** (6mm), N.A. **0.65**		
		Forward:		

Code Word	Cat. No.	Designation	Price Unit	Price Total
		Forwarded:	$	$
		Note: The following is furthermore required for **transmitted** light:		
MONIK	**2001a**	**Petrological Illuminating Apparatus,** same as No. 2001, model "b", with "*Nicol*" prism (*listed on page 114*), but supplied with special fitting to be attachable to the dove-tailed slider beneath the object stage of microscope "MOP"		
MERDU	**36055**	**Total Optical Equipment II:**		
		Note: In the event that the petrological illuminating apparatus No. 2001a is desired with different polarizing prisms, the following prices prevail:		
MOMSO	**2002a**	**Petrological Illuminating Apparatus,** similar to No. 2002, model "b", with "*Glan-Thomson*" prism (*listed on page 114*), but supplied with special fitting to be attachable to the dove-tailed slider beneath the object stage of the microscope "MOP"		
MOHRS	**2003a**	**Petrological Illuminating Apparatus,** similar to No. 2003, model "b", with "*Ahrens*" prism (*listed on page 114*), but supplied with special fitting to be attachable to the dove-tailed slider beneath the object stage of the microscope "MOP"		
		Note: To use microscope "MOP" for conoscopic observation of interference figures, we recommend:		
MOBET	**28024**	"*Bertrand*" **Lens,** to be screwed to the ocular 8X included in equipment "MOP" listed under code word MERZO		

Note: 1) As suitable source of light for both examinations under reflected and transmitted light, we recommend lamp No. 22580 (*listed on page 166*).

2) As suitable cameras for photo-micrographic work in connection with microscope "MOP," we recommend the attachment cameras Nos. 22719 and 22730 (*listed on pages 200-201*), and the roll film attachment camera No. 27700 (*listed on pages 202-203*).

3) For photo-micrography, a stronger source of light is required than listed under No. 22580 (*on page 166*); as a suitable source of illumination for this purpose, we recommend the special low voltage lamp No. 32800 (*listed on page 162*).

Pages 121 to 125 cover

METALLURGICAL MICROSCOPES

Th Leitz Works are considered pioneers in the development of metallurgical microscope equipments and are known to supply the most complete assortment of these instruments in a quality of unequalled precision. The Leitz "Micro-Metallograph" (inverted metal microscope with camera on bench), has for instance, been adopted as standard for research by Universities and leading Industrial Laboratories. This instrument has been awarded

"GRAND PRIX"

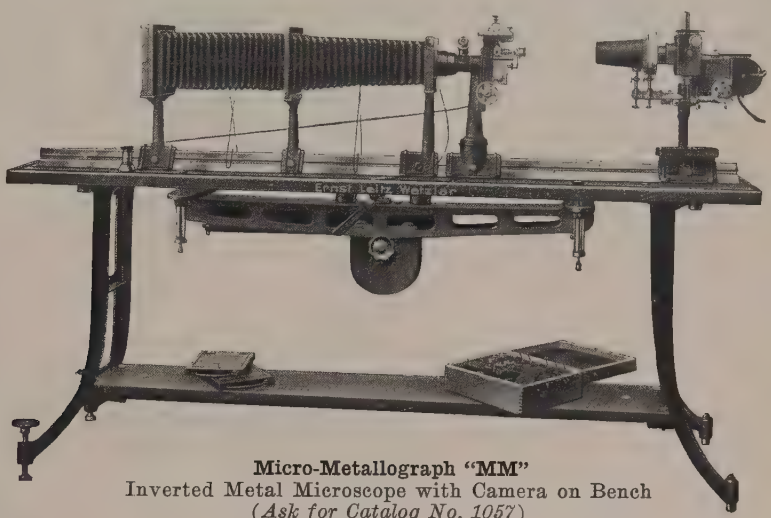
at

International Foundry and Steel Exposition

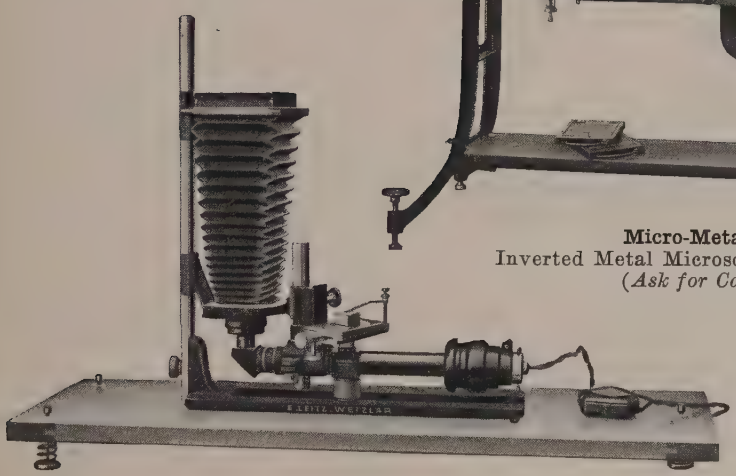
Paris, 1927

Inasmuch as the larger apparatus, viz., the "Micro-Metallograph" as well as the "Metallurscope" are instruments used in specialized fields and require a rather extensive description for a proper comprehension of their constituent parts, we have refrained from listing the more elaborate equipments in this catalog. We issue separate sections of literature dealing with the various groups of instruments we offer for micro-metallographic studies. The publications referred to are itemized at the foot of this page.

In the present catalog, we have restricted ourselves to describing only the smaller models of metallurgical microscopes such as are of most frequent interest to educational institutions.



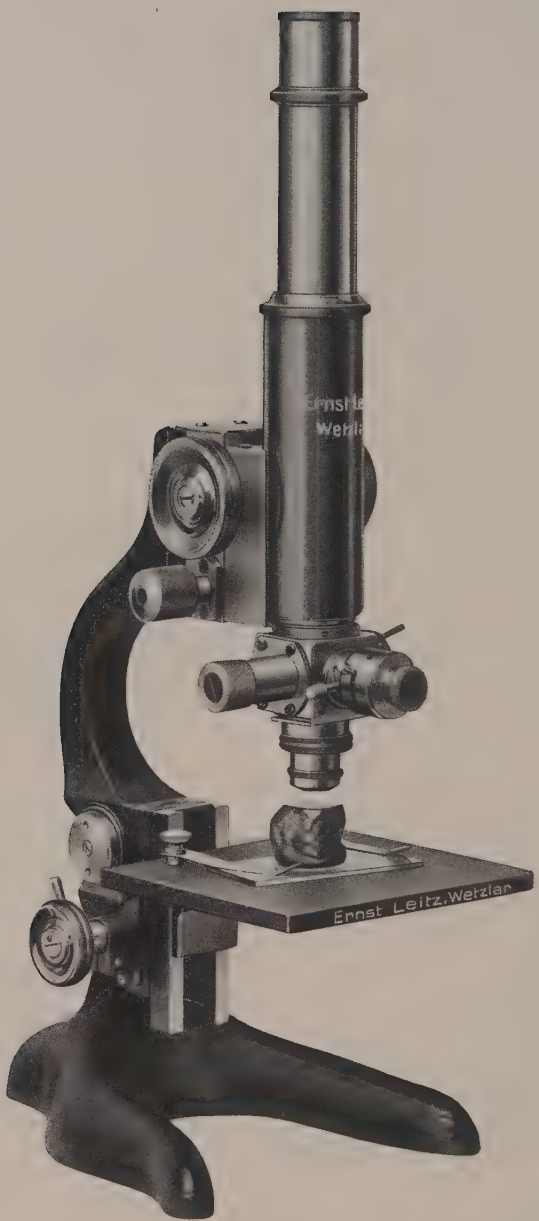
Micro-Metallograph "MM"
Inverted Metal Microscope with Camera on Bench
(*Ask for Catalog No. 1057*)



Metallurscope "MC"
Small Inverted Microscope with Camera
(*Ask for Catalog No. 1114*)

We offer the following sections of literature on instruments for Micro-Metallographic Analysis:

Catalog No. **1057**—Descriptive of **Micro-Metallograph "MM"**
Catalog No. **1089**—Descriptive of **Metallographic Microscopes**, smaller models
Catalog No. **1090**—Complete list of **Micro Objectives and Oculars** for metallography
Catalog No. **1092**—**Treatise on Grinding, Polishing and Etching of Metallographic Specimens**
Catalog No. **1093**—**Grinding and Polishing Machines** for metallographic specimens
Catalog No. **1094**—**Guthrie's Research Equipment for Grinding and Polishing** of metallographic specimens with automatic specimen holder
Catalog No. **1114**—**Metallurscope "MC"**
Pamphlet No. **1112**—**Microtome for Cutting Soft Metal Specimens**



METALLURGICAL MICROSCOPE "MO"

METALLURGICAL MICROSCOPE "MO"

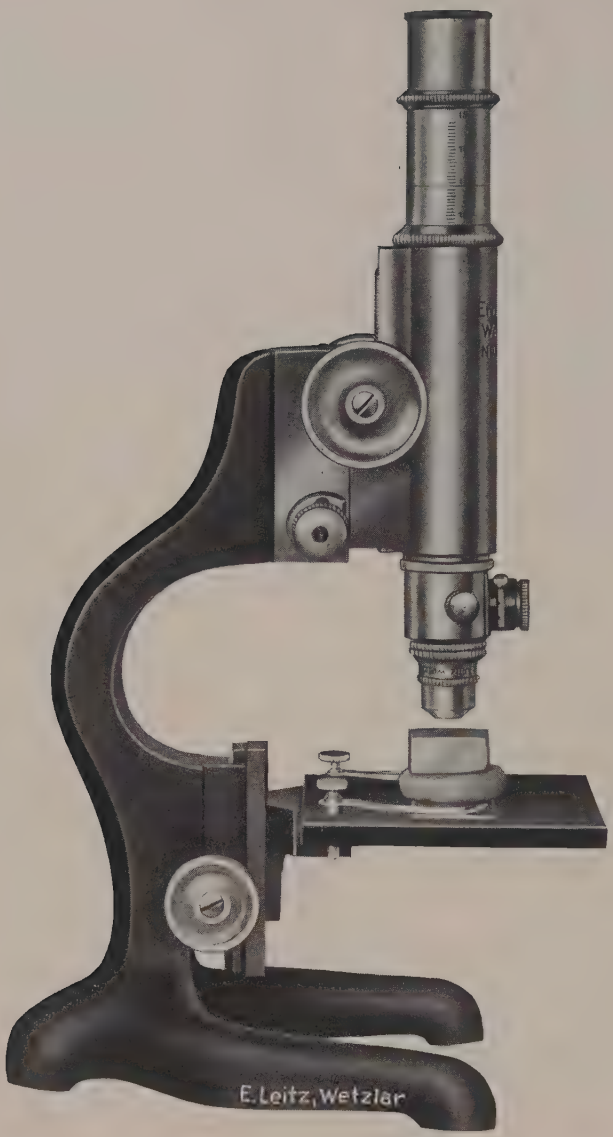
Microscope "MO," while more or less adapted for various purposes of microscopical investigations, has primarily been constructed for examining the properties of metals and alloys. It is well suited for use in other departments of technology; viz., practical application in metallographic laboratories and for accurately verifying in the course of any process, the scientific predetermined structural properties of given compositions of metals. The design of the instrument renders it available even for investigations lying entirely outside the province of metallurgy and it is therefore equally well adapted for biological work and other modes of observation.

Its wide range of use is due to the fact that the principal parts are detachable and interchangeable. **It is not only available for the examination of prepared specimens of metals on the microscope stage, but also, by removing the detachable tube and attaching it to a special stand having a vulcanite foot, this stand complete with tube may be placed upon any large or immovable object and the latter examined on the spot.** The microscope "MO" can moreover **be provided with an illuminating attachment for transmitted and polarized light** by replacing the square stage with a rotatable stage which is to be supplemented by using a substage condenser equipment. The instrument can furthermore be utilized for the examination of metal or other opaque specimens under polarized light by adding the polarizer No. 28018 attachable to the entrance tube of the vertical illuminator and the analyzer No. 28020, fitting over the ocular. Investigations under polarized transmitted light are carried out by utilizing a rotatable stage with graduated periphery, and a polarizer No. 28018 which fits into the condenser sleeve, and by placing the analyzer No. 28020 over the ocular.

The mechanical stand of microscope "MO" consists of a heavy horseshoe foot, handle arm with inclination joint, detachable monocular tube with millimeter scale, rectangular stage provided with circular aperture for transmitted light, covered with circular plate to close the opening for examination of opaque specimens; stage equipped with rack and pinion motion; rack and pinion for coarse focus; micrometer screw as fine adjustment. The stage (irrespective if one of square or round pattern is used) is mounted to a rack and pinion mechanism by which the preparation is focused, resulting in the advantage of leaving the light rays for opaque illumination undisturbed after once centered. A clamping device permits of fastening the stage rigidly in its desired vertical position.

Code Word	Cat. No.	Designation	Price
METAB	**MO-Oa**	**Microscope "MO",** complete as described, with vertical illuminator Nos. 22550 and 22552 (*listed on page 172*), but **without** objectives or oculars	**$**
METBO	**MO-Ba**	**Microscope "MO",** complete as described, with vertical illuminator Nos. 22550 and 22552 (*listed on page 172*), with achromatic objectives Nos. **22005, 4.3X** (32mm); **28100, 10X** (16mm); **28135, 62X** (3mm); "*Huyghenian*" oculars Nos. **22042, 6X; 22046, 10X; 22048, 12X** (*Magnification: 26-750X*); **in cabinet**	
METEF	**MO-Ca**	**Microscope "MO",** complete as described, with vertical illuminator Nos. 22550 and 22552 (*listed on page 172*), with achromatic objectives Nos. **22005, 4.3X** (32mm); **28100, 10X** (16mm); **28125, 30X** (6mm); **28135, 62X** (3mm); oil immersion **28140, 100X** (1.8mm), N.A. 1.30; "*Huyghenian*" oculars Nos. **22040, 5X; 22044, 8X; 22048, 12X;** "*Periplan*" ocular No. **22077, 20X** (*Magnification: 22-1800X*); **in cabinet**	
METIR	**MO-Da**	**Microscope "MO",** complete as described, with vertical illuminator Nos. 22550 and 22552 (*listed on page 172*), with achromatic objectives Nos. **22005, 4.3X** (32mm); **28100, 10X** (16mm); fluorite objectives Nos. **28200, 42X** (4.2mm); oil immersions **28220, 54X** (3.45mm), N.A. 0.95 and **28230, 95X** (1.95mm), N. A. 1.32; "*Huyghenian*" oculars Nos. **22042, 6X; 22046, 10X;** "*Periplan*" oculars Nos. **22073, 12X; 22077, 20X** (*Magnification: 26-2000X*); **in cabinet**	

Note: 1) As suitable source of illumination, we recommend the lamp No. 22580 (*listed on page 166*).
2) In the foregoing, we have restricted ourselves to list with the microscope "MO," only equipments for metallurgical investigations; if interested in likewise using this microscope for other modes of investigations, we shall gladly furnish Catalog No. 1089 in which the microscope "MO" and its complete line of accessories is described in detail.
3) If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 125*), and oculars (*listed on page 18*). **Add** this equipment to **"MO-O."**



METALLURGICAL MICROSCOPE "MB" for College Laboratories

In size and general construction, the microscope "MB" resembles model "MO" described on previous pages. Microscope "MB" is furnished without inclination joint; however, it has likewise a rack and pinion movement for the stage facilitating the focus of the specimen. Microscope "MB" is not arranged as universal model with the result that stages and other accessory units are not interchangeable, a feature which is particularly evident with microscope "MO."

The microscope "MB" is offered as a simplified metallurgical microscope particularly suited for work in college laboratories and will answer this purpose in a most ideal manner.

As suitable sources of illumination, we recommend the lamps Nos. 22580 or 22583a (*listed on page 166*). These lamps provide a stationary source of light permanently aligned to the optical center of the vertical illuminator irrespective of the focusing motion to which the microscope tube is subjected.

Code Word	Cat. No.	Designation	Price
MEYRK	**MB-O**	**Microscope "MB"**, complete as described, with simplified vertical illuminator No. 22556 (*listed on page 173*), but **without** objectives or oculars, **in cabinet**	$
MEYOD	**MB-A**	**Microscope "MB"**, complete as described, with simplified vertical illuminator No. 22556 (*listed on page 173*), with achromatic objectives Nos. **22005, 4.3X** (32mm); **28100, 10X** (16mm); "*Huyghenian*" oculars Nos. **22042, 6X; 22046, 10X** (*Magnification: 22-103 X*); **in cabinet**	
MEYPL	**MB-B**	**Microscope "MB"**, complete as described, with simplified vertical illuminator No. 22556 (*listed on page 173*), with achromatic objectives Nos. **22005, 4.3X** (32mm); **28100, 10X** (16mm); **28135, 62X** (3mm); "*Huyghenian*" oculars Nos. **22042, 6X; 22046, 10X; 22048, 12X** (*Magnification: 26-750 X*); **in cabinet**	

Note: 1) As suitable source of illumination, we recommend the lamps Nos. 22580 or 22583a (*listed on page 166*).

2) If a different optical equipment than listed is desired, we suggest selection of objectives (*listed on page 125*), and oculars (*listed on page 18*). **Add** this equipment to **"MB-O."**

MICRO OBJECTIVES FOR THE EXAMINATION OF METAL AND OTHER OPAQUE SPECIMENS

Objectives for metallographic examination depart in certain respects from the formulae of the standard micro objectives for observation under transmitted light, for instance:

Leitz **objectives for the examination of opaque objects are corrected for a mechanical tube length of 215mm**; the correct position of the draw tube should be noted in order to obtain maximum efficiency.

These objectives are, moreover, short mounted, in order that the outer surface of the back lens of the objective may be as close as possible to the rim of the mounting. This is necessary so that the objective lenses may be brought close to the prism or glass plate reflector of the vertical illuminator for the purpose of obtaining a uniform illumination of the object and obviating the formation of a haze on the image.

Code Word		Cat. No.		Magn. No.	Equivalent Focal Length mm	Old Designation No.	N.A.	Working Distance mm	Micrometer Value* with Ocular 6X mm	Price	
Standard Type	Free from Polarization	Standard Type	Free from Polarization							Standard Type	Free from Polarization
				Achromatic Objectives						$	$
				(This series of objectives is described in detail on page 13)							
ACUBE	PUTRU	**22002**	**22002a**[1])	**3.2X**	**40**	1	**0.12**	34.5	0.049		
ACABA	PUTDA	**22005**	**22005b**[1])	**4.3X**	**32**	1b	**0.15**	27	0.037		
ACEDU	PUTST	**22006**	**22006b**[1])	**6X**	**24**	2	**0.20**	16	0.0275		
MADRI	PUTTN	**28100**	**28101**[1])	**10X**	**16**	3	**0.25**	5.8	0.0156		
MAMEL	PUTIL	**28105**	**28106**[2])	**10X**	**16**	16mm	**0.25**	0.65	0.016		
MATIG	PUTGY	**28110**	**28111**[1])	**16X**	**14**	14mm	**0.40**	3.5	0.013		
MAVIR	PUTIY	**28115**	**28116**[1])	**20X**	**9**	4	**0.45**	2.0	0.008		
MANAT	PUTJF	**28120**	**28121**[2])	**22X**	**8**	8mm	**0.65**	0.45	0.008		
MABUT	PUTPZ	**28125**	**28126**[1])	**30X**	**6**	5	**0.65**	0.75	0.005		
MASEX	PUTWK	**28130**	**28131**[1])	**45X**	**4**	6	**0.85**	0.32	0.0036		
MASIB	PUTXP	**28135**	**28136**[1])	**62X**	**3**	7	**0.85**	0.28	0.0025		
MALIM	PUTYC	**28140**	**28141**[2])	**100X**	**1.8**	1/12	**1.30**	0.11	0.0016		
				Fluorite (Semi-Apochromatic) Objectives							
				(This series of objectives is described in detail on page 13)							
MAFAL	PUTHX	**28200**	**28201**[1])	**42X**	**4.2**	6a	**0.85**	0.38	0.0038		
MAFOR	PUTZG	**28205**	**28206**[1])	**58X**	**3.2**	7a	**0.85**	0.28	0.0028		
MAFUN	PYLAM	**28210**	**28211**[1])	**70X**	**2.6**	8a	**0.90**	0.25	0.0023		
MAFYS	PYLBE	**28215**	**28216**[1])	**85X**	**2.2**	9a	**0.90**	0.13	0.0018		
MAFIX	PUTKM	**28220**	**28221**[2])	**54X**	**3.45**	1/7a	**0.95**	0.20	0.003		
MAFET	PUTMO	**28225**	**28226**[2])	**70X**	**2.6**	1/10a	**1.30**	0.18	0.0022		
MAFRA	PUTLD	**28230**	**28231**[2])	**95X**	**1.95**	1/12a	**1.32**	0.11	0.0017		
MALFI	PUTNR	**28235**	**28236**[2])	**114X**	**1.6**	1/16a	**1.32**	0.08	0.0014		
				Apochromatic Objectives							
				(This series of objectives is described in detail on page 14)							
MAVZE	PYLCO	**28257**	**28258**[1])	**12X**	**16**	16mm	**0.30**	5.0	0.0143		
MAPOK	PYLDA	**28260**	**28261**[1])	**23X**	**8**	8mm	**0.65**	0.85	0.0072		
MAPES	PYLEB	**28265**	**28266**[1])	**46X**	**4**	4mm	**0.95**	0.20	0.0035		
MAPIT	PYLFY	**28270**	**28271**[1])	**65X**	**3**	3mm	**0.95**	0.15	0.0026		
MAVOL	PYLGI	**28275**	**28276**[2])	**65X**	**3**	3mm	**1.32**	0.13	0 0025		
MAVER	PYLHV	**28280**	**28281**[2])	**65X**	**3**	3mm	**1.36**	0.13	0.0025		
MAPLO	PUTOV	**28285**	**28286**[2])	**92X**	**2**	2mm	**1.32**	0.11	0.00175		
MAPAX	PYLIN	**28290**	**28291**[2])	**92X**	**2**	2mm	**1.36**	0.05	0.00175		

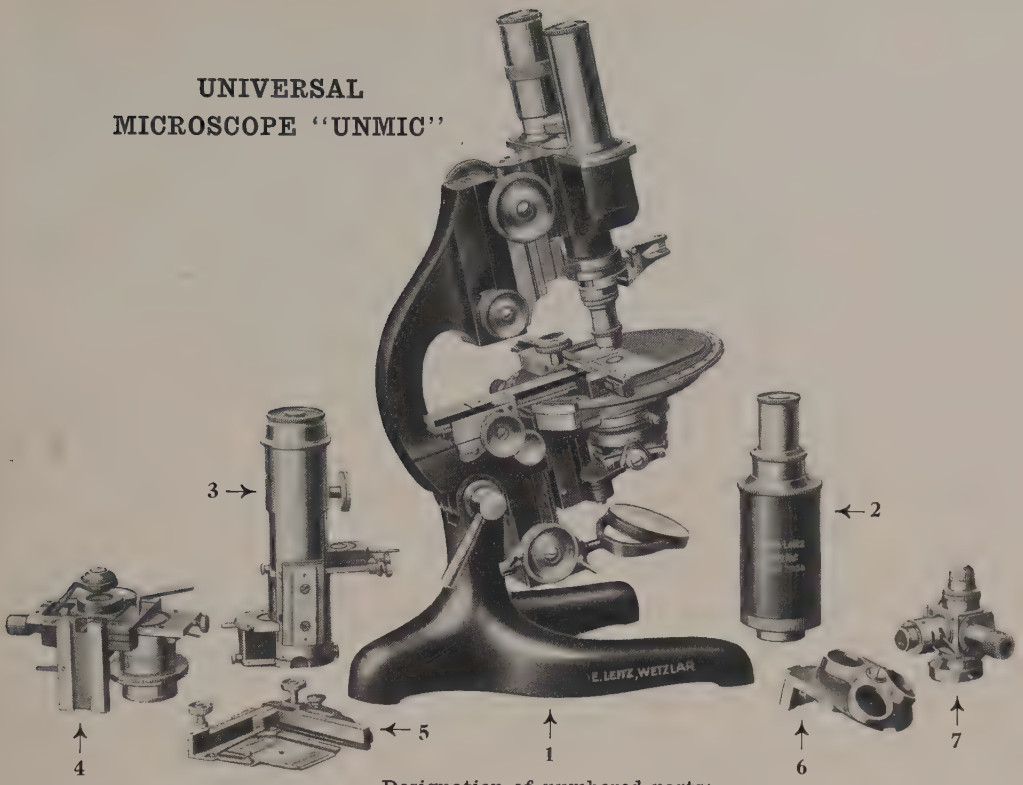
* Value on the stage of 0.1mm in the focal plane of the ocular.
1) Dry lenses.
2) Oil immersion objectives.

Note: We refrain from repeating the listing of micro oculars for the reason that those employed for biological investigations are likewise used in the examination of opaque objects. For detailed description and optical characteristics of the oculars, we refer to pages 15 and 18.

Pages 127 to 131 cover

UNIVERSAL MICROSCOPES

UNIVERSAL MICROSCOPE "UNMIC"



Designation of numbered parts:

1) *Universal Microscope with the following accessories attached: Binocular Body, Objective Clutch Changer, Large Biological Mechanical Stage and Biological Substage;*
2) *Standard Monocular Tube;*
3) *Polarizing Tube;*
4) *Polarizing Substage;*
5) *Mineralogical Mechanical Stage;*
6) *Triple Nosepiece with Adapter;*
7) *Vertical Illuminator with Centering Adapter.*

Universal Microscope "UNMIC" represents an instrument which denotes precision and reflects Leitz ingenuity in microscope construction.

In reviewing the simple microscope used during the middle of the last century and in comparing its plain and inadequate design with the latest developments in microscope construction—the Leitz Universal Microscope—one will readily conceive the tremendous progress made by optical science and ***the important place the Leitz Works occupy in this noble field of endeavor.***

The development of the Leitz universal microscope "UNMIC" has been the result of many recommendations and through conferences held with leading microscopists. Due to their suggestions combined with the untiring efforts on the part of the Leitz Works, this instrument has been perfected and is now offered to those research microscopists who have repeatedly felt the dire need of a microscope of such universal application. In the Leitz universal microscope, every phase of construction as to mechanical and optical details bears evidence of the thought that prevailed to have this instrument designed in a manner to do justice to every theoretical as well as practical experience in the field of microscopy and to permit its application in a precise yet simple manner. An important feature is that each individual part, such as, *monocular tube, binocular tube, petrographical tube, objective nosepiece, objective clutch, biological substage, petrographical substage, biological mechanical stage, petrographical mechanical stage, vertical illuminator, etc.,* **is quickly interchangeable with each other, and at the same time each unit aligns itself automatically and likewise with absolute precision to the optical axis.** The object under observation and the mirror of the substage need not be disturbed when the change is made from one unit to another.

The universal application of microscope "UNMIC" covers:

A: Biological investigations with ordinary transmitted light;
(*at monocular and binocular vision*)
B: Biological investigations with polarized transmitted light;
(*at monocular and binocular vision*)
C: Petrographical investigations with polarized transmitted light;
(*at monocular and binocular vision*)
D: Petrographical investigations with polarized reflected light;
(*at monocular and binocular vision*)
E: Investigation of opaque specimens, metals, etc., with reflected light.
(*at monocular and binocular vision*)

Note: In order to comprehend the elaborate construction of the universal microscope "UNMIC," a complete description is essential, and while due to lack of space in this catalog, we cannot give a delineated analysis of this instrument, we refer to special Pamphlet No. 1067 in which this microscope is carefully described in all its details. (*Continued on page 128*)

UNIVERSAL MICROSCOPE "UNMIC"—(Continued)

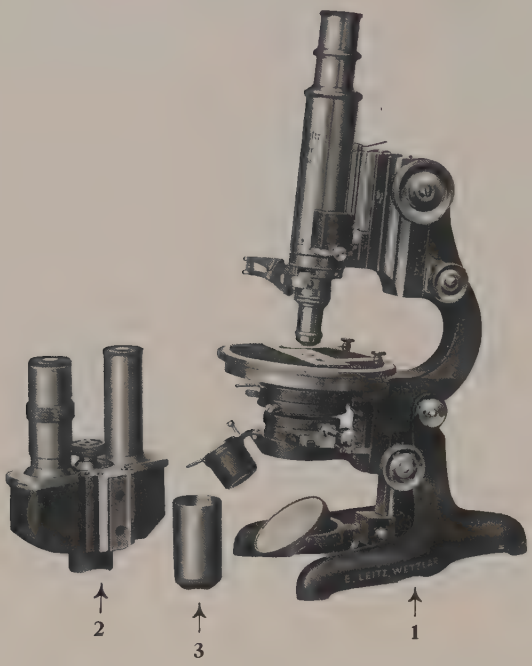
Code Word	Cat. No.	Designation	Price Unit	Price Total
AUSTI	**22750**	**Microscope Stand "UNMIC"** with horseshoe base, joint with clamping lever, rotatable object stage provided with disengageable micrometer screw for rotation, scale at its periphery and vernier read within 0.05° of rotation, the stage focusable by rack and pinion, lever for arresting the position of the stage; coarse focusing device by rack and pinion; fine adjustment by micrometer screw with ball-bearing and divided drum, one interval of which equals 0.001mm; plano-concave mirror attached to universal joint and focusable slider adjustable independently of condensing system; substage carrier with rack and pinion focus but without condenser; **without cabinet**.....	$	$
		A—Accessories for Biological Investigation:		
AUBLA	**22752**	**Biological Substage,** interchangeable pattern, with dove-tailed slider; swing-out carrier with rotatable iris diaphragm, mounted to rack and pinion for oblique illumination; spring sleeve for the accommodation of condensers and centering adapters; but without condenser.....		
POCON	**22754**	**Centering Adapter** for condensers, complete with two keys		
ILPEN	**22758**	**Achromatic-Aplanatic Condenser N.A. 1.40,** with demountable lens-segments, for use in connection with low, medium and high power objectives; condenser in mounting to suit the centering adapter No. 22754.....		
CONUT	**22762**	**Bicentric Darkfield Condenser Model A,** N.A. 1.20, in mounting to suit the centering adapter No. 22754.....		
ILBRO	**22766**	**Spectacle Condenser,** low power for use with "Micro-Summars".....		
AUFMO	**22844**	**Monocular Tube**, 50mm diameter, interchangeable pattern, with draw tube.....		
ABBLI	**22846**	**Monocular Tube,** 50mm diameter, **with side telescope,** interchangeable pattern, with draw tube for photo-micrographic work, permitting constant observation of specimen, when microscope is connected with the camera.....		
AUFBI	**22842**	**Binocular Body Tube,** with rack and pinion for adjustment to interpupillary distance.....		
AUVER	**22607**	**Nosepiece, Quadruple,** dustproof, attached to adapter for insertion into the dove-tailed groove at the microscope stand		
PLATA	**22612**	**Mechanical Stage,** large pattern, permits slides in size up to 50x100mm.....		
AUTAR	**22768**	**Total Equipment A, for Biological Investigation:**	.....	
		B—Accessories for Investigation in Polarized Light:		
AUMAL	**22770**	**Polarizing Substage,** interchangeable pattern, with dove-tailed slider; five-lens condenser N.A. 0.85 of which upper unit is mounted to swinging arm; two iris diaphragms; "*Ahrens*" prism as polarizer.....		
AUTIM	**2007a**	**Condenser,** immersion, auxiliary unit, interchangeable with the upper section of No. 22770, N.A. 1.45, for use in connection with objectives of higher N.A. than 0.85.....		
AUTUS	**22772**	**Polarizing Tube,** interchangeable pattern, with slit 45° for the accommodation of compensators; rotatable anastigmatic tube analyser with correction lens and scale to read rotation in steps of 5°, "*Amici-Bertrand*" lens in centering mount with iris diaphragm and provided with rack and pinion focusing device; flange for support of cap nicol with graduated circle and index; ocular adapter permitting use of oculars of standard diameter.....		
AULIS	**22774**	**Adapter with Correction Lens,** to be screwed to the binocular body tube for using the latter in connection with the polarizing tube and converting same for utilization under binocular vision in polarized light.....		
		Forward:		

(*Continued on page 129*)

UNIVERSAL MICROSCOPE "UNMIC"—(Continued)

Code Word	Cat. No.	Designation	Price Unit	Price Total
		Forwarded:	$	$
AUZAG	**22776**	**Objective Clutch Changer,** attached to adapter for insertion into the dove-tailed groove at the microscope stand, including three objective centering adapters (interchangeable with the quadruple nosepiece)		
PIRUX	**2230**	**Mechanical Stage,** mineralogical (*listed on page 115*)		
AUMIN	**22778**	**Total Equipment B, for Investigation in Polarized Light:**		
		C—Accessories for Investigation in Reflected Light:		
OPAGE	**22552**	**Opaque Illuminator,** large model, for use with objectives of medium and high power, with total reflecting prism and reflecting plate, both mounted simultaneously to one slider; including three objective adapters (*listed on page 172*)		
OPABO	**22550**	**Frame,** with reflecting glass plate, serving as illuminant for low power objectives (*listed on page 172*)		
OPACA	**22780**	**Total Equipment C, for Investigation in Reflected Light:**		
MOPRA	**28028**	**Polarizer,** to be attached to the entrance tube of the opaque illuminator, for use in reflected, **polarized** light		
AUCAS	**22782**	**Cabinet,** mahogany, with lock and key, for the Universal Microscope and **Case,** mahogany, with lock and key, for the accessories		
AULED	**22784**	**Two Trunks, Leather,** to accommodate both cabinet and case, No. 22782		
		OR:—		
AUSEL	**22786**	**Two Trunks, Canvas,** to accommodate both cabinet and case, No. 22782		
		D—Optical Equipment for Biological Investigation:		
		Select from objectives listed on pages 16-17 and oculars listed on page 18.		
		E—Optical Equipment, for Investigation in Polarized Light:		
		Select from objectives listed on page 113 and oculars listed on page 113.		
		F—Optical Equipment, for Investigation in Reflected Light:		
		Select from objectives listed on page 125 and oculars listed on page 18.		

BIOLOGICAL POLARIZING MICROSCOPE "CBMP"



Designation of numbered parts:

1) *Microscope "CBMP" with Polarizing Tube attached, showing the Rotatable Polarizer swung from optical center;*

2) *Binocular Tube;*

3) *Auxiliary Adapter with Lens to be screwed to binocular tube when using same in conjunction with polarizing tube.*

The importance of having available for biological microscopical work, a conveniently arranged polarizing microscope, has prompted the Leitz Works to give careful consideration to this subject. In collaboration with leading microscopists, the Leitz Works succeeded in perfecting a special microscope to meet this particular field of endeavor in an ideal manner, and introduced the biological polarizing microscope "CBMP."

Polarizing accessories previously offered for use in connection with biological microscopes scarcely permitted microscopical investigations in polarized light in a satisfactory manner or for universal application due to various restrictions which were always in evidence; for instance, reduced size of field of view when using the cap nicol, difficulties in keeping the ocular crosslines in adjustment relative to the nicol prism, considerable reduction in numerical aperture of the substage condenser when polarizer is inserted, etc. The Biologist and Research Worker, when desiring to pursue more or less far-reaching investigations under polarized light, were heretofore, for reasons outlined, compelled to resort to the use of microscopes primarily adapted for petrographical observations. These microscopes, no matter how elaborately equipped, are chiefly constructed to meet the requirements which arise in mineral studies and are never intended to permit in a satisfactory manner the expectations which are in evidence for the examination of biological preparations in polarized light. A polarizing microscope, in order to represent an ideal instrument of universal application for biological microscopy, must aside from its polarizing qualities be so constructed as not to impair in any way, the investigations in ordinary unpolarized light.

The microscope "CBMP" resembles in its mechanical design, the general series of Leitz combination microscopes and in size corresponds to the Leitz research models. To serve the intended purposes in an admirable and ideal manner, it is equipped at the substage with a rotatable polarizer attached to a hinge, and when swinging the polarizer aside, the substage condenser is then identical to those used on standard research microscopes. The monocular tube is provided with an analyzer mounted to a dove-tailed slider and therefore can be inserted or withdrawn conveniently from the optical rays. The objective clutch attaches by a separate support to the rack and pinion track of the stand in a detachable manner and serves for the quick interchange of objectives. The latter by means of centering adapters are held in place by a spring clamp. The objective, once centered, remains permanently centered. The interchangeable feature of the tubes permits the microscope to be used equally as satisfactorily for monocular as well as for binocular vision in either ordinary or polarized light. To summarize, the microscope "CBMP" is therefore available for biological investigations

A: In **ordinary** transmitted light, under **monocular** and **binocular** vision;

B: In **polarized** transmitted light, under **monocular** and **binocular** vision.

Note: In order to comprehend the elaborate construction of the microscope "CBMP," a complete description is essential, and while due to lack of space in this catalog, we cannot give a delineated analysis of this instrument, we refer to special Pamphlet No. 1069 in which this microscope is carefully described in all its details.

(*Continued on page 131*)

BIOLOGICAL POLARIZING MICROSCOPE "CBMP"—(Continued)

Code Word	Cat. No.	Designation	Price Unit	Price Total
PACMP	**22900**	**Biological Polarizing Microscope "CBMP",** consisting of: stand with horseshoe base and joint for tilting; rotatable object stage of 110mm diameter with scale and vernier; coarse focusing mechanism by rack and pinion; fine adjustment by continuous motion micrometer screw with ball-bearing at the sliding surfaces and divided drum at one micrometer head, one interval at the drum equals 0.002mm; large illuminating apparatus "a" with aplanatic-achromatic condenser N.A. 1.40, having demountable lens units, provided with centering sleeve, iris diaphragm for stage and iris diaphragm mounted to horizontal rack and pinion for oblique illumination, polarizer in rotatable mounting fastened to swing-out fitting, the entire substage unit attached to rack and pinion carrier for the focus of the illuminating apparatus; plano-concave mirror, mounted to slider and universal joint in an independent manner of the illuminating apparatus, lever for clamping mirror rigidly in place, **without cabinet**	$	$
		A. Essential Accessories:		
COPUX	**22902**	**Mineralogical Monocular Tube,** interchangeable, with anastigmatic tube analyser; the draw tube and gliding sleeve being removable by means of eccentric lever device; draw tube provided with millimeter scale		
AUFBI	**22842**	**Binocular Body Tube,** interchangeable, with rack and pinion adjustment for interpupillary distance		
COPOR	**22904**	**Auxiliary Adapter with Correction Lens,** attachable to the binocular tube, in order to use the latter for binocular vision in connection with the monocular polarizing tube		
COZAG	**22906**	**Objective Clutch Changer,** mounted to separate support, attachable to the rack and pinion track of the microscope stand with slot at 45° for the accommodation of compensators, complete with three objective adapters		
KOGIP	**2023**	**Selenite Plate,** red, 1st order, in metal mounting		
KOMER	**2024**	**Mica Plate,** 1/4 λ, in metal mounting		
PACAL	**22908**	**Total Equipment A:**		
COSUR	**22910**	**Cabinet,** mahogany, to accommodate microscope stand and above accessories, with lock and key		
PIRUX	**2230**	**Mechanical Stage,** compound, which by means of a screw attaches to the revolving object stage, the cross motions having a range of 30mm, either movement by means of scales and verniers, permitting reading of displacement of the specimen within 0.1mm, the object clamp so arranged as to hold slides of different size, **in case**		
DECSV	**22614**	**Mechanical Stage,** compound, standard pattern, which attaches to the side of the microscope stand; it accommodates slides in size up to 38x75mm; the forward and backward movement being controlled by rack and pinion, the sideward motion by worm screw drive; scales and verniers are provided for both movements and permit recording the position of specimens within 0.1mm, **in case** (*listed on page 171*)		
		In respect to the selection of optical equipment, we refer to: *For objectives, free from polarization, page 113.* *For standard objectives, pages 16-17.* *For oculars with adjustable eye lens and crosshairs, page 113.* *For standard oculars, page 18.*		

Pages 133 to 155 cover

BINOCULAR STEREO MICROSCOPES

WIDE FIELD BINOCULAR MICROSCOPES "BSM"

Wide field binocular microscopes are particularly useful for the examination of gross specimens in anatomy, botany, dermatology, embryology, entomology, geology, histology, metallography, mineralogy, zoology, etc. These instruments furthermore permit of a most universal application for a large variety of manufacturing methods and control work in industrial plants.

The wide field binocular microscope "BSM" represents an instrument having various possibilities of application. On page 133 are illustrated six different models for selection and consequently, the microscope is capable of adaptation to all and any particular requirements. We are furthermore prepared to construct special stands to order if any one of the various models is not found to suit the individual conditions.

In case it is desirable to illuminate opaque objects, we recommend the use of those lamps listed on page 135 under No. 22581-B, and adapters Nos. 22581-C and 22581-D. The ball socket stage No. 22202 (*listed on page 144*) orients the specimens to any desired position and therefore serves as a convenient support for opaque objects in connection with the various stands. The ball socket stage likewise accommodates Petri dishes and consequently every one of the stands can readily be converted into a microscope for the examination of plate cultures at any slanted position desired.

The wide field binocular microscopes permit viewing the object in its true position. The image is not inverted or reversed. The **pronounced stereoscopic effect** as rendered by these microscopes is of particular advantage in dissection work where the perception of three dimensions is very important.

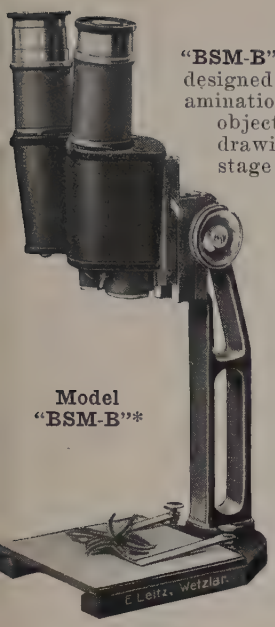
The wide field binocular microscopes "BSM" offer the advantages of **extremely large field under a wide range of magnifications, decided stereoscopic vision, long working distance,** and **high eye point** for convenient observation with the customary eye-glasses.

Through the binocular vision and the highly corrected optical components, eye-strain is eliminated.

The favorable optical characteristics such as large field of view and long working distance, will be readily appreciated after the reader familiarizes himself with the tables of optical constants, given on page 135.

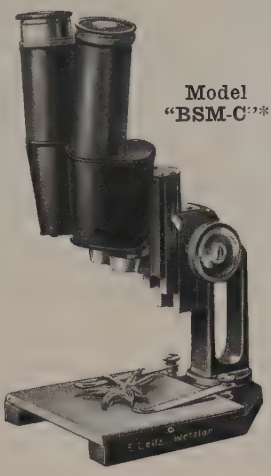
(*Continued on page 133*)

BINOCULAR MICROSCOPES "BSM"—(Continued)



Model "BSM-B"*

"BSM-B" is especially designed for the examination of opaque objects. In withdrawing the glass stage plate, the microscope maybeplaced directly on the object. **"BSM-B" is used only with the binocular body of low power No. 22100.**

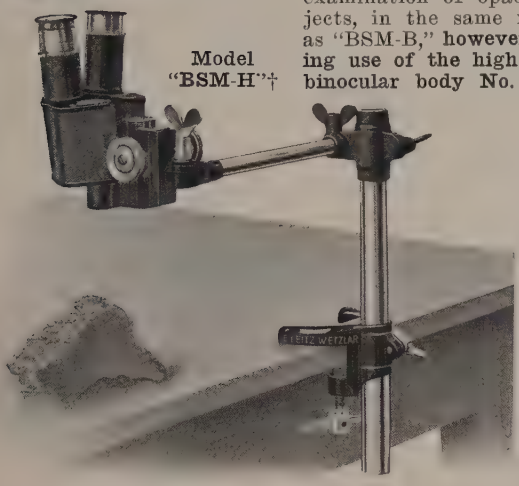


Model "BSM-C"*

"BSM-C" is likewise especially designed for the examination of opaque objects, in the same manner as "BSM-B," **however, making use of the high power binocular body No. 22102.**

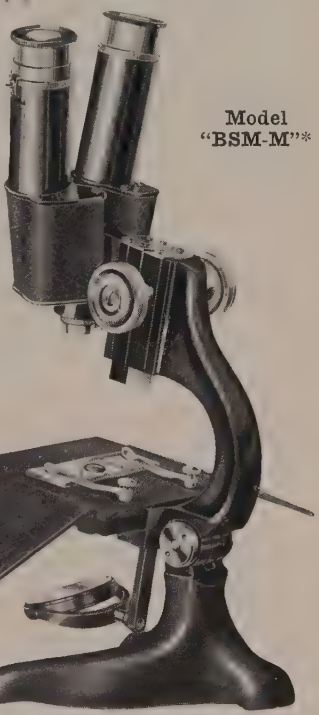
Model "BSM-D"†

"BSM-D" represents an instrument of wide range of usefulness; the horizontal arm moves along the vertical column by means of a rack and pinion, the horizontal arm being inclinable and carries a universal joint for the binocular body.



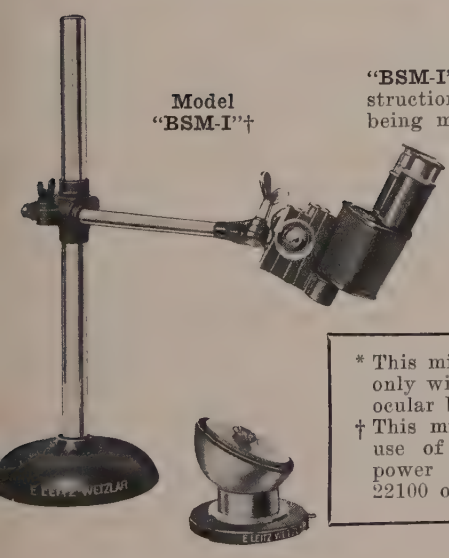
Model "BSM-H"†

"BSM-H" represents a model of convenient construction, being clamped to the working table; it is equipped with various joints to afford adjustment in a most universal manner. **Both low and high power binocular bodies Nos. 22100 and 22102 can be used interchangeably.**



Model "BSM-M"*

"BSM-M" represents the conventional form of microscope stand and is most conveniently arranged for examination of transparent objects; placing opaque specimens upon the stage, it is likewise adapted for the examination of these. **"BSM-M" is used only with the high power binocular body No. 22102.**



Model "BSM-I"†

"BSM-I" is similar in construction to BSM-H except being mounted to a heavy iron foot. **Both low and high power binocular bodies Nos. 22100 and 22102 can be used interchangeably.**

* This microscope can be used only with the particular binocular body, so designated.

† This microscope permits the use of either low or high power binocular body Nos. 22100 or 22102.

(*Continued on page 134*)

BINOCULAR MICROSCOPES "BSM"—(Continued)

Code Word	Cat. No.	Designation	Price
			$
ABCOT	22113	**Stand "BSM-B" alone,** consisting of handle arm and base, as illustrated and described on page 133, **in hardwood carrying case,** with lock and key..... (No rack and pinion, binocular body or oculars are included.)	
ABCUR	22121	**Stand "BSM-C" alone,** consisting of handle arm and base, as illustrated and described on page 133, **in hardwood carrying case,** with lock and key..... (No rack and pinion, binocular body or oculars are included.)	
ASKEM	22126	**Stand "BSM-D" alone,** consisting of stand as illustrated and described on page 133, **without** case..... (No rack and pinion, binocular body or oculars are included.)	
AVEGI	22156	**Stand "BSM-H" alone,** consisting of stand as illustrated and described on page 133, **without** case..... (No rack and pinion, binocular body or oculars are included.)	
AVELB	22166	**Stand "BSM-I" alone,** consisting of stand as illustrated and described on page 133, **without** case..... (No rack and pinion, binocular body or oculars are included.)	
AVEXN	22196	**Stand "BSM-M" alone,** consisting of stand with stage, mirror and hand rests, as illustrated and described on page 133, **in hardwood carrying case,** with lock and key..... (No rack and pinion, binocular body or oculars are included.)	
ARYCU	22104	**Rack and Pinion Slider,** for use with above stands..... (*Regardless of which stand is selected, one rack and pinion slider must be ordered.*)	
		Binocular Prism Bodies (*Their selection is dependent upon the particular stand desired and the magnification required.*)	
ARYAC	22100	**Binocular Prism Body*—low power**—with one pair of stationary mounted objectives, **in case**..... (No. 22100 is used with "BSM-B", "BSM-D", "BSM-H" and "BSM-I".)	
ARYBA	22102	**Binocular Prism Body†—high power**—with one pair of stationary mounted objectives, **in case**..... (No. 22102 is used with "BSM-C", "BSM-D", "BSM-H", "BSM-I" and "BSM-M".) *When ordering this body for use with "BSM-B" which includes a cabinet for the complete stand, the case for the binocular body may be eliminated, therefore, **deduct $.** †When ordering this body for use with "BSM-C" and "BSM-M" which include a cabinet for the complete stand, the case for the binocular body may be eliminated, therefore, **deduct $.**	
		Paired Oculars (*One ocular is adjustable to eye difference.*)	
ARYDI	22106	**Paired Oculars "A-5"**—magnification with body No. 22100 = 3.5X and with body No. 22102 = 10X.....	
ARYES	22108	**Paired Oculars "A-10"**—magnification with body No. 22100 = 7X and with body No. 22102 = 20X.....	
ARYFE	22110	**Paired Oculars "A-15"**—magnification with body No. 22100 = 10.5X and with body No. 22102 = 30X.....	
ARYLY	22111	**Paired Oculars "A-20"**—magnification with body No. 22100 = 13.5X and with body No. 22102 = 40X.....	

Suggestion for the selection of equipments:

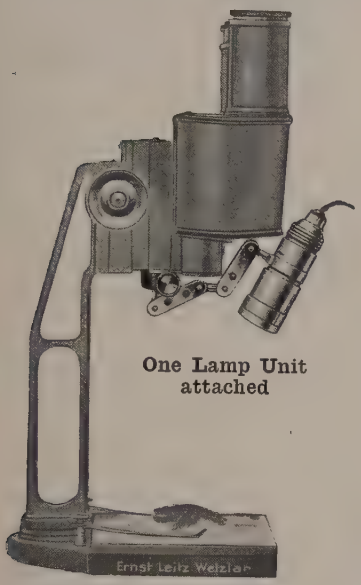
Microscope Stand to suit the particular requirements.
Rack and Pinion Slider No. 22104.
Low or High Power Binocular Body No. 22100 or 22102, respectively, according to magnification desired (observe in this connection to which stand the one or other body or both are applicable).
Paired Oculars according to required magnification.

(*Continued on page 135*)

BINOCULAR MICROSCOPES "BSM"—(Continued)

Table of Optical Characteristics

	With **low power** Prism Body **No. 22100**			With **high power** Prism Body **No. 22102**		
	Magnification	Field of view diameter mm	Free Working Distance mm	Magnification	Field of view diameter mm	Free Working Distance mm
Paired Oculars "A-5" ..	**3.5X**	45	150	**10X**	16	80
Paired Oculars "A-10"..	**7X**	30	145	**20X**	10	78
Paired Oculars "A-15"..	**10.5X**	20	140	**30X**	7	75
Paired Oculars "A-20"..	**13.5X**	14	135	**40X**	6	70



One Lamp Unit attached

Illuminants for Binocular Microscopes

For the examination of opaque objects of any character, we offer suitable lamps, which by means of holders are attached to the rack and pinion slider.

Either one or two lamps can be utilized to illuminate the necessary area.

Two Lamp Units attached

Code Word	Cat. No.	Designation	Price
LIMIN	**22581-B**	**One "Mignon" Lamp 8-volt, 0.6 ampere, without foot,** provided with ball-socket arms to afford a universal orientation of lamp for illumination from any desired angle, 6 ft. cord, plug and one extra lamp bulb.....	$
LOLAX	**22581-C**	**One Single Screw Adapter,** into which fits the jointed arm of the lamp, for attaching same to any stand of binocular microscopes....	
LIMIN	**22581-B**	**Two "Mignon" Lamps, 8-volt, 0.6 ampere, without foot,** each provided with ball-socket arms to afford universal orientation of lamps for illumination from any desired angle, **each $**	
LOLIG	**22581-D**	**Two Double Screw Adapters,** into which fit the jointed arms of the lamps, for attaching two lamps to any stand of binocular microscopes **Note:** *The adapter is first inserted into the dove-tailed groove of the rack and pinion casing and then the rack and pinion slider on top of same.* **Dependent upon the available current, either a rheostat or transformer is to be used in connection with the above lamps; viz.,**	
RACAQ	**32970**	**Rheostat, 110**-volt, **D.C.**.....	
RACBZ	**32972**	**Rheostat, 220**-volt, **D.C.**.....	
REKEY	**32978**	**Rheostat, 110-220**-volt, combination model, with ammeter, available for **D.C.** and **A.C.**.....	
RACCH	**32974**	**Transformer, 110**-volt, **A.C.**.....	
RACDS	**32976**	**Transformer, 220**-volt, **A.C.**.....	
LISEY	**32980**	**Lamp Bulb,** 8-volt, 0.6 ampere.....	

Note: 1) The Dissecting Stage No. 22200 as well as the Ball-Socket Stage No. 22202, illustrated and described in connection with Binocular Microscope "UBM" (*page 144*), are likewise of advantageous use for the Binocular Microscope "BSM."

2) The Attachment Cameras listed under Nos. 22719a-22732a (*page 145*) may also be utilized with the Binocular Microscope "BSM."

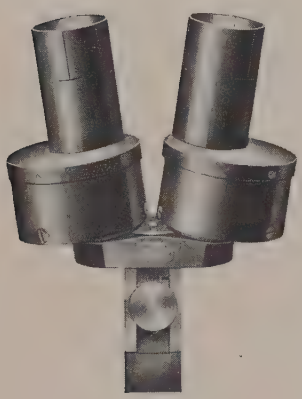
WIDE FIELD BINOCULAR MICROSCOPES "UBM"

with Interchangeable Pairs of Objectives

Like the preceding model "BSM," the new binocular microscope model "UBM" is available for a similar range of application; however, it has the **added feature of permitting interchangeable use of nine different pairs of objectives.** Through the use of oculars of exceptionally large diameter, the microscope "UBM" yields an extremely wide field and therefore permits the examination of extended areas so that consequently, with an objective of lower power, **a large object is covered completely without it being necessary to shift the specimen. The usefulness of the instrument is further increased through its long working distance** which allows full advantage to be taken of the complete range of adjustments afforded by the various mechanical stands with which the microscope can be used and furthermore, ample hand room is allotted for dissecting work. **The pronounced stereoscopic effect which the binocular microscope "UBM" renders,** due to binocular vision, is recognized as a particular advantage in dissecting work where the perception of three dimensions (width, depth, height) is a most essential factor. The high eye-point of the oculars permits the use of the customary eye-glasses.

The Universal Binocular Microscope "UBM" fills the following conditions in a most ideal manner:

1. Extremely large field (maximum 45mm diameter).
2. Long working distance (maximum 120mm).
3. Large size of objective lenses increases the brilliancy by approximately 50%.
4. Increased stereoscopic vision due to the wide angle between the two lines of vision.
5. Prolonged use does not fatigue the observer's eyes.
6. It is available for use with a variety of different mechanical stands.
7. The image is erected and reproduces the object in its actual orientation, in other words, in the identical position as seen with the naked eye.
8. High eye-point permits use of spectacles.
9. Various magnifications through the use of nine pairs of objectives and four pairs of oculars.
10. Magnifications from 4-216X diameters are obtainable.



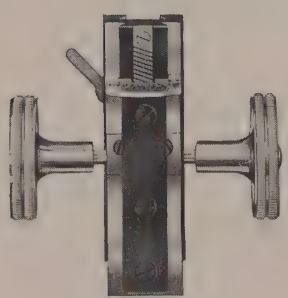
No. 32000

Binocular body No. 32000 *for microscope "UBM"* resembles, in general construction, the body of the well known series of *"Greenough-Leitz"* binocular microscopes, however, being slightly modified so as to widen its range of adaptation. The new design of this binocular body permits the use of special low power objectives, endowed with large field and long working distance, **as well as the full series of objectives of the** *"Greenough"* **microscope,** which are of higher power.

The construction of the new binocular body provides for a smaller angle between the eyepieces than prevails for the objectives and in this manner the identical perspective is retained as prevails with the *"Greenough"* microscope and consequently also the feature of absence from eye-strain.

The binocular body is provided with a dove-tailed projection which is made to slide into the dove-tailed groove of the rack and pinion focusing mechanism. Since the rack and pinion slider is equipped with an eccentric lever, the body locks rigidly in place, truly aligned to the optical axis. Through this convenient and precise mechanism, the body can be quickly interchanged from one mechanical stand to another.

Code Word: UBABS **Price: $**



No. 32005

Focusing Mechanism No. 32005 *for microscope "UBM"* consists of a double slider provided with rack and pinion, having finely cut teeth of utmost durability. The dove-tailed female groove of the one slider serves as a receptacle for the binocular body in which the latter is clamped rigidly in place by means of an eccentric lever. The second slider has a dove-tailed projection which is made to attach to a female groove on the microscope stand. Such construction requires only one rack and pinion if the binocular body is to be made use of in an interchangeable manner with various microscope stands.

Code Word: UBACH

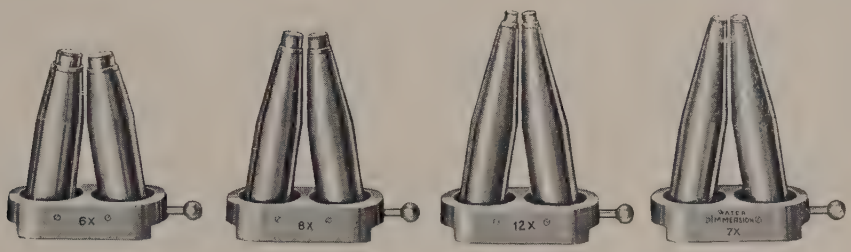
Price: $

(*Continued on page 137*)

BINOCULAR MICROSCOPES "UBM"—(Continued)

Paired Objectives

Catalog No.:	32010	32015	32020	32025	32030
Price:	$	$	$	$	$
Initial Magnification: ..	0.75X	1.0X	2.0X	3.0X	4.0X
Focal Length, mm:	60	62	55	46	40
Code Word:	UBADT	UBAEF	UBAFI	UBAGA	UBAHO



Catalog No.:.....	32035	32040	32045	32050*
Price:	$	$	$	$
Initial Magnification:..	6.0X	8.0X	12.0X	7.0X
Focal Length, mm:	30	24	18	25
Code Word:	UBAIB	UBAJU	UBAKY	UBALP

** No. 32050 represents a water immersion objective.*

The low power (wide angle) objectives 0.75X and 1.0X are provided with a dove-tailed track by means of which they slide over the dove-tailed projection beneath the binocular body and in this manner rest tightly against the prism housing. (From this explanation it will be clear that in using these objectives the adapter No. 32055 is not required.)

The objectives of higher power (2.0X to 12.0X) can be utilized only through the interposition of the adapter No. 32055, as explained under No. 32055.

Due to the large lenses with which the objectives are equipped, the brilliancy of the image is increased by approximately 50%.

Objective Adapter No. 32055 *for microscope "UBM"* provides means whereby the standard series of *"Greenough"* objectives can be attached to the body tube of the universal binocular microscope "UBM." The binocular body carries beneath the prism housing a dove-tailed projection over which the objective adapter, being provided with a dove-tailed groove, slides tightly against the housing. A screw serves the purpose to clamp the adapter rigidly in place.

No. 32055

For the reason that the assortment of *"Greenough"* objectives is of such an extended range we did not include these in the equipments 2, 4 and 6 (*listed on pages 138-139*). If any *"Greenough"* objectives are desired in addition to the low power objectives listed with equipments 2, 4 and 6, **it is essential to order the objective adapter No. 32055 and the** *"Greenough"* **objectives** (*listed above*); **namely, those as may be required.**

Code Word: UBAMZ.
Price: $

(*Continued on page 138*)

BINOCULAR MICROSCOPES "UBM"—(Continued)

Paired Oculars

These oculars are of high optical correction and designed in such manner as to completely cover the exceptionally large field rendered by the series of special wide angle objectives. The oculars are of a diameter of 30mm, corrected for chromatic aberration as well as curvature of field and possess a high eye point to permit the convenient use of spectacles. Each pair of oculars has one of them provided with an adjustable eye lens to permit compensating the difference between the eyes of the observer.

Catalog No.:	32060	32065	32070	32075
Price:	$	$	$	$
Initial Magnification:	5X	8X	12X	18X
Focal Length, mm:	50	31	20	14
Code Word:	UBANE	UBAOD	UBAPX	UBARC

Table of Magnifications of Optical Characteristics of Objectives and Oculars for Microscope "UBM"

				OCULARS:							
Cat. No.				32060		32065		32070		32075	
Designation				5X*		8X		12X		18X	
OBJECTIVES:											
Cat. No.	Designation	Focal Length mm	Working Distance mm	Magnification	Field of view mm	Magnification	Field of view mm	Magnification	Field of view mm	Magnification	Field of view mm
32010	**0.75X**	60	120	4	45	6	30	9	24	14	16
32015	**1X**	62	120	5	30	8	23	12	18	18	12
32020	**2X**	55	82	–	—	16	12	24	9	36	6
32025	**3X**	46	60	–	—	24	8	36	6	54	4
32030	**4X**	40	48	–	—	32	6	48	5	72	3
32035	**6X**	30	34	–	—	48	4	72	3	108	2
32040	**8X**	24	27	–	—	64	3	96	2.5	144	1.5
32045	**12X**	18	19	–	—	96	2	144	1.5	216	1
32050	**7X****	25	22	–	—	56	3	84	2.6	126	1.7

* *The paired oculars 5X can only be used in connection with the objectives 0.75X and 1X.*
** *The paired objectives 7X represent a water immersion.*

Illuminants for Microscope "UBM"

For the examination of opaque objects of any character, we offer suitable lamps which by means of holders are attached to the rack and pinion slider. Either one or two lamps can be utilized to illuminate the area beneath the objectives.

Note: For use with microscope "UBM" the very same illuminants are available as are illustrated and described in connection with microscopes "BSM" on page 135, from which please make your selection.

Optical Equipments for Microscope "UBM"

In the following we list as aid in the ordering of microscope outfits for various requirements, four different optical equipments, assorted to render magnifications for diversified fields of investigation:

Equipment No. 2

(*Covers a restricted assortment for low power work*)

No. 32010 **Paired Objectives**, wide angle, low power, **0.75X** (60mm)
No. 32070 **Paired Oculars, 12X**
(*Combined Magnification: 9X*)
No. 36070 .....**Total Equipment No. 2:** $_____
Code Word: UGUFI

(*Continued on page 139*)

BINOCULAR MICROSCOPES "UBM"—(Continued)

Equipment No. 4

(Affords a somewhat wider range of application than No. 2)

No. 32010 **Paired Objectives,** wide angle, low power, **0.75X** (60mm)
No. 32015 **Paired Objectives,** wide angle, low power, **1.0 X** (62mm)
No. 32060 **Paired Oculars 5X**
No. 32070 **Paired Oculars 12X**
(Combined Magnification: 4-12X) _____
No. 36072 .....**Total Equipment No. 4:** $_____
Code Word: UGUGY

Equipment No. 6

(Constitutes a rather complete assortment of optics for low power work, covering a wide field)

No. 32010 **Paired Objectives,** wide angle, low power, **0.75X** (60mm)
No. 32015 **Paired Objectives,** wide angle, low power, **1.0X** (62mm)
No. 32020 **Paired Objectives,** wide angle, low power, **2.0X** (55mm)
No. 32060 **Paired Oculars 5X**
No. 32070 **Paired Oculars 12X**
No. 32075 **Paired Oculars 18X**
(Combined Magnification: 4-36X) _____
No. 36074 .....**Total Equipment No. 6:** $_____
Code Word: UGUHZ

Equipment No. 8

(Covers in addition to the low power, wide angle objectives, an assortment of medium and high power "Greenough" objectives. This equipment affords a wide range of application under low as well as medium and high magnifications and consequently represents a very popular assortment.)

No. 32010 **Paired Objectives,** wide angle, low power, **0.75X** (60mm)
No. 32020 **Paired Objectives,** wide angle, low power, **2.0X** (55mm)
No. 32030 **Paired Objectives,** *"Greenough,"* **4X** (40mm)
No. 32040 **Paired Objectives,** *"Greenough,"* **8X** (24mm)
No. 32045 **Paired Objectives,** *"Greenough,"* **12X** (18mm)
No. 32055 **Adapter** for using the *"Greenough"* objectives on the binocular tube
No. 32060 **Paired Oculars 5X**
No. 32070 **Paired Oculars 12X**
No. 32075 **Paired Oculars 18X**
(Combined Magnification: 4-216X) _____
No. 36076 .....**Total Equipment No. 8:** $_____
Code Word: UGUIF

Mechanical Stands for Microscope "UBM"

For use with the binocular body we have provided an assortment of different microscope stands by means of which the instrument can be made applicable in a most far-reaching manner, irrespective of the character, size and shape of the specimen to be examined. It will, therefore, be evident that in obtaining the binocular body, rack and pinion slider, a suitable assortment of objectives as well as oculars and one or more stands, depending upon the nature of work and specimens involved, an equipment is available that does not impose any restrictions of application. Each stand is provided with a female dove-tailed groove for the accommodation of the rack and pinion slider with binocular body.

Inasmuch as each stand of microscope "UBM" is likewise listed without optics, any desired equipment can easily be selected to meet all existing requirements. The table on page 138 enumerates all the magnifications obtainable with the various combinations of objectives and oculars permitting one to judge those optics which are required dependent upon the magnification desired. **Even if at the beginning an instrument is ordered with a small equipment, additional objectives and oculars can be purchased at any later time since all the optics of the binocular microscope "UBM" are interchangeable.**

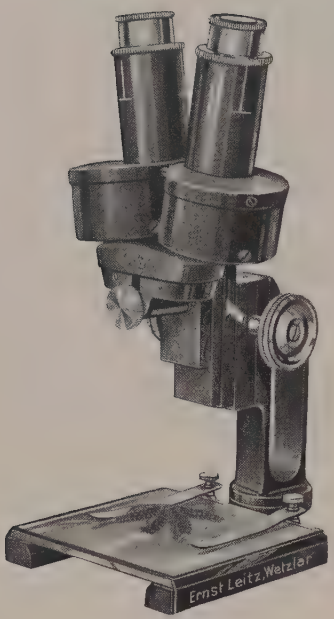
As guide towards selecting a complete equipment varying from those enumerated above and listed with each microscope stand, we give the following example:

Stand proper (*all those listed with each group* **without** *optics*)
Rack and pinion slider No. 32005 (*listed on page 136*)
Binocular Body No. 32000 (*listed on page 136*)
Wide Angle Objectives, to be selected from Nos. 32010-32020 (*listed on page 137*)
"Greenough" **Objectives,** to be selected from Nos. 32025-32050 (*listed on page 137*)
Adapter for *"Greenough"* objectives, No. 32055 (*listed on page 137*)
Oculars, to be selected from Nos. 32060-32075 (*listed on page 138*)

Note: If we are advised of the individual requirements that the binocular microscope "UBM" has to meet, we shall be pleased to offer our suggestions towards the proper equipment to be selected.

(Continued on page 140)

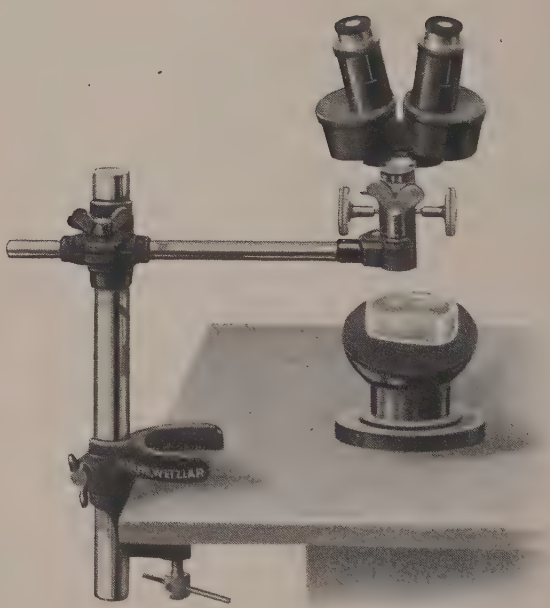
BINOCULAR MICROSCOPES "UBM"—(Continued)



Binocular Microscope "UBM-C"

Binocular Microscope "UBM-D"

Binocular Microscope "UBM-F"



Binocular Microscope "UBM-H"

Note: The above microscopes are described on page 141.

(*Continued on page 141*)

BINOCULAR MICROSCOPES "UBM"—(Continued)

Binocular Microscope "UBM-C"—(*See illustration on page 140.*)
The stand of microscope "UBM-C" consists of a handle arm, attached to a base plate in a demountable manner. The latter is provided with a sliding glass plate which serves as support for the specimen. The base plate is equipped with a pair of long stage clips for clamping the specimen in place.
The handle arm has a dove-tailed groove which accommodates the rack and pinion slider and the latter again accommodates the binocular body. An eccentric lever clamps these parts securely in place.
The microscope "UBM-C" affords a most universal application for the examination of either small or large opaque objects under reflected light. By withdrawing the sliding glass plate, the instrument can be placed directly upon objects too large to be accommodated on the base plate; adjusted in this manner the microscope will likewise serve for the examination of specimens suspended in museum jars.
Inasmuch as the handle arm of the stand is detachable, the base plate can be removed and in this manner the binocular body with handle arm mounted to the dissecting stage No. 22200 (*listed on page 144.*)

Binocular Microscope "UBM-D"—(*See illustration on page 140.*)
The stand of microscope "UBM-D" consists of a heavy iron base to which is attached a vertical pillar of massive construction. A rack is embedded into the vertical pillar, extending over its entire length. A movable socket with strong pinion glides over the vertical pillar, affording a coarse movement and focus to the horizontal arm, it being mounted in such manner as to rest upon the socket with pinion. The latter is provided with a set-screw by which the pinion socket can be locked at any desired position. Above the horizontal arm, at the vertical pillar, a clamping ring is situated for the purpose of locking the arm in order to prevent any accidental sideward displacement during examination.
The horizontal arm is provided with a joint to allow inclination within its horizontal plane so as to permit examination of any part of the specimen. At its extreme end the horizontal arm carries a universal joint for orientation within the vertical and horizontal axis. The universal joint is provided with a dove-tailed groove which accommodates the rack and pinion slider and the latter receives the binocular body. An eccentric lever clamps these parts securely in place.
The microscope "UBM-D" is available for a most far-reaching application since the binocular body can be oriented in all planes and directions, thereby making it most useful and rendering it serviceable for investigations of widest range. The binocular body can be inclined to the proper plane of any object, regardless if mounted in a horizontal or vertical position.

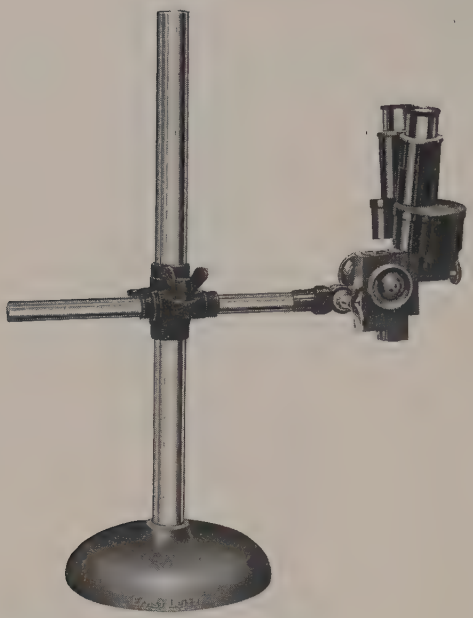
Binocular Microscope "UBM-F"—(*See illustration on page 140.*)
The stand of microscope "UBM-F" is provided with a table clamp to which is attached a clamping screw permitting a convenient adjustment of the stand to any desired height. At the upper end the stand carries an inclinable joint for proper orientation of the binocular body relative to the specimen.
As an inexpensive stand the model "UBM-F" is favored for student work in Anatomy, Botany, Zoology and similar branches of science.

Binocular Microscope "UBM-H"—(*See illustration on page 140.*)
The stand of microscope "UBM-H" is provided with a table clamp to which is attached a strong upright pillar, sliding thereon a heavy clamping socket within which glides a horizontal arm. This arm may be shifted to give the binocular body any desired extension or proper orientation relative to the specimen and can be securely clamped in place at any such positions. At the extreme end of the horizontal arm is provided a universal joint which facilitates the easy orientation of the binocular body to any position as may be desired.
This stand is in extensive use for the examination of coarse specimens and extremely useful in all Biological Departments when objects are to be viewed which vary greatly in size. The extension arm with its universal movement accommodates for these objects in an ideal manner.

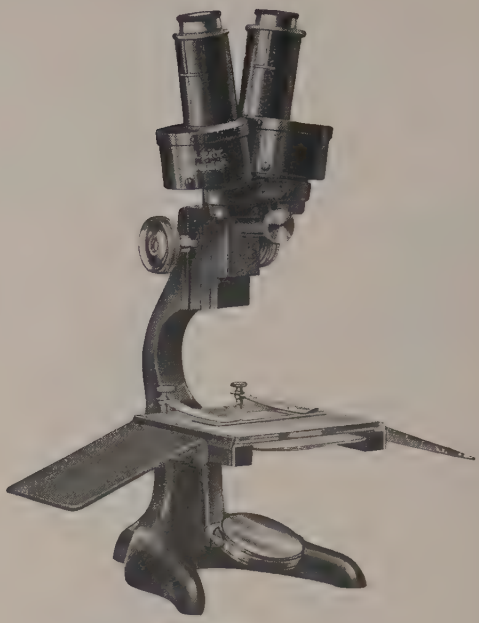
Code Word	Cat. No.	Designation	Price
UBASM	UBM-C	**Binocular Microscope "UBM-C",** stand alone, consisting of handle arm and base plate, **without** binocular body, focusing mechanism, objectives or oculars, complete **in case**	$
UGUJE	UBM-C1	**Binocular Microscope "UBM-C",** same as above, but **with** binocular body No. 32000 and focusing mechanism No. 32005	
UCEAP	UBM-D	**Binocular Microscope "UBM-D",** stand alone, **without** binocular body, focusing mechanism, objectives, oculars or cabinet	
UGUKU	UBM-D1	**Binocular Microscope "UBM-D",** same as above, but **with** binocular body No. 32000 and focusing mechanism No. 32005 and case for holding binocular body with space provided for optics	
UCEUL	UBM-F	**Binocular Microscope "UBM-F",** stand alone, **without** binocular body, focusing mechanism, objectives, oculars or cabinet	
UGULV	UBM-F1	**Binocular Microscope "UBM-F",** same as above, but **with** binocular body No. 32000 and focusing mechanism No. 32005 and case for holding binocular body with space provided for optics	
UCEZE	UBM-H	**Binocular Microscope "UBM-H",** stand alone, **without** binocular body, focusing mechanism, objectives, oculars or cabinet	
UGUMR	UBM-H1	**Binocular Microscope "UBM-H",** same as above, but **with** binocular body No. 32000 and focusing mechanism No. 32005 and case for holding binocular body with space provided for optics	

Note: The above microscopes are listed on page 143 with various equipments of objectives and oculars, included.
(*Continued on page 142*)

BINOCULAR MICROSCOPES "UBM"—(Continued)



Binocular Microscope "UBM-I"



Binocular Microscope "UBM-M"

Binocular Microscope "UBM-I"—

The stand of microscope "UBM-I" is in every respect identical to model "UBM-H" with the exception that it is provided with a round iron base to rest upon the working table instead of being supplied with a table clamp. Stand "UBM-I" is given preference over model "UBM-H" in such instances when provisions cannot be readily made for clamping the stand to a table. The usefulness of "UBM-I" is further enhanced due to the fact that it can be conveniently moved wherever a specimen is to be examined.

This instrument is in particular demand by the various Biological Departments since it does not impose any restrictions in application either due to size of object or its shape.

FOR **INDUSTRIAL PURPOSES** "UBM-I" IS ESPECIALLY RECOMMENDED ON ACCOUNT OF ITS UNIVERSAL APPLICATION AND DUE TO IT BEING EASILY TRANSFERABLE FROM ONE WORKING BENCH TO ANOTHER.

Binocular Microscope "UBM-M"—

Model "UBM-M" represents the standard type of microscope stand and meets the requirements of average microscopical work involving the examination of opaque as well as transparent objects. The stand consists of a heavy horseshoe base, handle arm with inclination joint, mirror with one surface plano and the other concave.

The stage measures 100 x 105mm and is provided with a thick glass plate serving as support for the specimen; beneath this plate the metal frame carries a groove to accommodate a ground glass plate producing diffused light, while an additional plate, with one surface black and the other white, can be inserted in its place, serving as background for dark and light objects, respectively. The stage is equipped with one pair of clips and one pair of metal hand rests.

Model "UBM-M" represents the accepted microscope stand for general work in Biology and Geology as well as many other fields of investigation.

Code Word	Cat. No.	Designation	Price
UDIET	**UBM-I**	**Binocular Microscope "UBM-I",** stand alone, **without** binocular body, focusing mechanism, objectives, oculars or cabinet	$
UGUNT	**UBMI-1**	**Binocular Microscope "UBM-I",** same as above, but **with** binocular body No. 32000 and focusing mechanism No. 32005 and case for holding binocular body with space provided for optics.....	
UDIRU	**UBM-M**	**Binocular Microscope "UBM-M",** stand alone, **without** binocular body, focusing mechanism, objectives or oculars, complete **in case**	
UGUOK	**UBM-M1**	**Binocular Microscope "UBM-M",** same as above, but **with** binocular body No. 32000 and focusing mechanism No. 32005.....	

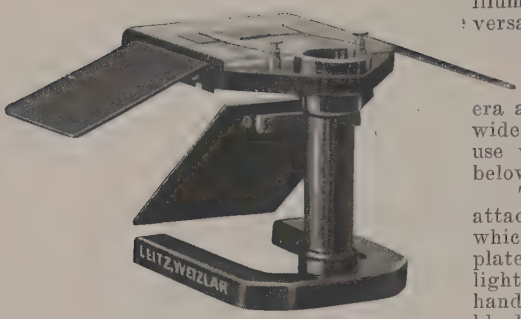
Note: The above microscopes are listed on page 143 with various equipments of objectives and oculars, included.

(*Continued on page 143*)

BINOCULAR MICROSCOPES "UBM"

listed with various equipments of objectives and oculars

Code Word	Cat. No.	Designation	Price
UBATN	**UBM-C2**	**Binocular Microscope "UBM-C1"**, with optical equipment No. **2** (*listed on page 138*), **in case**	$
UBAUK	**UBM-C4**	**Binocular Microscope "UBM-C1"**, with optical equipment No. **4** (*listed on page 139*), **in case**	
UBABL	**UBM-C6**	**Binocular Microscope "UBM-C1"**, with optical equipment No. **6** (*listed on page 139*), **in case**	
UBAWG	**UBM-C8**	**Binocular Microscope "UBM-C1"**, with optical equipment No. **8** (*listed on page 139*), **in case**	
UCEBU	**UBM-D2**	**Binocular Microscope "UBM-D1"**, with optical equipment No. **2** (*listed on page 138*)	
UCECY	**UBM-D4**	**Binocular Microscope "UBM-D1"**, with optical equipment No. **4** (*listed on page 139*)	
UCEEK	**UBM-D6**	**Binocular Microscope "UBM-D1"**, with optical equipment No. **6** (*listed on page 139*)	
UCEFT	**UBM-D8**	**Binocular Microscope "UBM-D1"**, with optical equipment No. **8** (*listed on page 139*)	
UCEVI	**UBM-F2**	**Binocular Microscope "UBM-F1"**, with optical equipment No. **2** (*listed on page 138*)	
UCEWS	**UBM-F4**	**Binocular Microscope "UBM-F1"**, with optical equipment No. **4** (*listed on page 139*)	
UCEXM	**UBM-F6**	**Binocular Microscope "UBM-F1"**, with optical equipment No. **6** (*listed on page 139*)	
UCEYM	**UBM-F8**	**Binocular Microscope "UBM-F1"**, with optical equipment No. **8** (*listed on page 139*)	
UDIAB	**UBM-H2**	**Binocular Microscope "UBM-H1"**, with optical equipment No. **2** (*listed on page 138*)	
UDIBS	**UBM-H4**	**Binocular Microscope "UBM-H1"**, with optical equipment No. **4** (*listed on page 139*)	
UDICA	**UBM-H6**	**Binocular Microscope "UBM-H1"**, with optical equipment No. **6** (*listed on page 139*)	
UDIDE	**UBM-H8**	**Binocular Microscope "UBM-H1"**, with optical equipment No. **8** (*listed on page 139*)	
UDIFO	**UBMI-2**	**Binocular Microscope "UBMI-1"**, with optical equipment No. **2** (*listed on page 138*)	
UDIGZ	**UBMI-4**	**Binocular Microscope "UBMI-1"**, with optical equipment No. **4** (*listed on page 139*)	
UDIHY	**UBMI-6**	**Binocular Microscope "UBMI-1"**, with optical equipment No. **6** (*listed on page 139*)	
UDIKR	**UBMI-8**	**Binocular Microscope "UBMI-1"**, with optical equipment No. **8** (*listed on page 139*)	
UDISH	**UBM-M2**	**Binocular Microscope "UBM-M1"**, with optical equipment No. **2** (*listed on page 138*), **in case**	
UDITM	**UBM-M4**	**Binocular Microscope "UBM-M1"**, with optical equipment No. **4** (*listed on page 139*), **in case**	
UDIUP	**UBM-M6**	**Binocular Microscope "UBM-M1"**, with optical equipment No. **6** (*listed on page 139*), **in case**	
UDIVN	**UBM-M8**	**Binocular Microscope "UBM-M1"**, with optical equipment No. **8** (*listed on page 139*), **in case**	



No. 22200

Dissecting Stage No. 22200 is offered for transillumination of specimens in connection with the universal binocular microscopes **"UBM-C," "UBM-D," "UBM-F," "UBM-H"** and **"UBM-I."** It is likewise available for photo-micrography of large objects in transmitted light with camera arranged in vertical position. (For this purpose wide angle photo objectives are required and for their use we supply suitable illuminating lenses, as listed below.)

The dissecting stage consists of a metal base attached thereto a vertical pillar, holding the stage which provides a metal frame in which slides a glass plate. A large mirror, 90 x 120mm, provides ample light for transmitted illumination. A pair of metal hand rests serves for dissecting. A plate, on one side black and the other white, slides beneath the stage and is used for reflected light. In this manner the background can be stimulated suitably to create proper contrast for the specimen to be examined.

No. 22202

Ball-Socket Stage No. 22202 is used for observation in reflected light in connection with the universal binocular microscopes **"UBM-D," "UBM-F," "UBM-H"** and **"UBM-I."** It furthermore offers special advantages towards convenient orientation of specimens for photo-micrography.

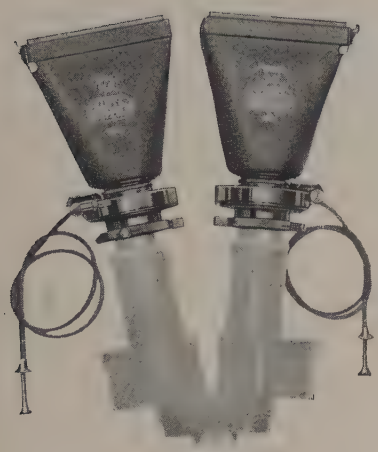
The ball-socket stage consists of a hemispherical base which fits into a socket, mounted on a base plate. The socket is provided with a rubber suction cup whereby the hemisphere is securely held in place at any desired position. The hemispherical base likewise carries in its center a rubber suction cup which holds flat objects, such as glass plates, glass dishes, etc., rigidly in place regardless of the position or angle at which the hemispherical base is situated.

This stage affords a universal orientation to any object placed thereon and fills a long existing demand. Through the absence of such a convenient device the proper orientation of objects for the intended purpose has been previously accompanied with difficulty.

Note: Both Stages Nos. 22200 and 22202 can be used to the same advantage in connection with the binocular microscope "BSM" (*listed on pages 132-135*).

Code Word	Cat. No.	Designation	Price
ASKAL	**22200**	**Dissecting Stage,** as described, **without case** **Note:** *For photo-micrography in connection with the dissecting stage, wide angle photo objectives are required and in order to afford adequate illumination for these objectives, we supply suitable condensing lenses, as follows:*	$
UFOPE	**32150**	**Illuminating Lens,** in mounting, for "Micro-Summar" 24mm	
UFORC	**32155**	**Illuminating Lens,** in mounting, for "Micro-Summar" 35mm	
UFOSF	**32160**	**Illuminating Lens,** in mounting, for "Micro-Summar" 42mm	
UFOTI	**32165**	**Illuminating Lens,** in mounting, for "Summar" 64mm	
UFOUG	**32170**	**Illuminating Lens,** in mounting, for "Summar" 80mm	
UFOVN	**32175**	**Illuminating Lens,** in mounting, for "Summar" 100mm	
UFOWM	**32180**	**Illuminating Lens,** in mounting, for "Summar" 120mm	
ASKOC	**22202**	**Ball-Socket Stage,** as described, **without case**	
		MONOCULAR TUBES—for Interchangeable Use on the Stands of the Binocular Microscope "UBM":	
AWLAN	**293**	**Monocular Tube,** diameter 35mm, for measuring purposes	
DECET	**22644**	**Micrometer Ocular (6X),** with movable scale, 10mm divided in 100 parts, and adjustable eyelens, **in case** (*for use with monocular tube No. 293*)	
AWSEF	**294**	**Monocular Tube, large diameter** (50mm), for photo-micrography, likewise serviceable for wide angle photography without ocular	
ABBLI	**295**	**Monocular Tube, large diameter** (50mm), with side telescope, for photo-micrography, **in case** (*No. 295 permits constant visual observation of the specimen up to the moment of exposure, even if the microscope has been connected with the camera.*)	

PHOTO-MICROGRAPHIC CAMERAS FOR OBTAINING STEREO PICTURES WITH BINOCULAR MICROSCOPES "UBM"



These cameras permit in a most simple manner and with easy manipulation the taking of *Stereo* photo-micrographic pictures in conjunction with the binocular microscopes "UBM," either upon plates or films 1¾ x 2⅜ in. or 3¼ x 4¼ in. and reproduce images of direct visual observation in a true manner.

The cameras are placed over the oculars of the microscope and are rigidly held in place by means of screw adapters. Through the accompanying ground glass screen the image is focused sharply by manipulating the rack and pinion of the microscope.

With each camera is supplied a shutter for time and instantaneous exposure. The plate holder or filmpack adapter, respectively, slide easily into the appointed frame and are securely held in place by two snap-springs. Pressing upon two small levers releases them instantly for withdrawal from the frame.

Note: These cameras represent in their general construction our standard attachment cameras for use with compound microscopes (*listed on pages 200-201*). Through the addition of the observation side-telescope and *"Periplan"* ocular 8X, listed separately below, the stereo cameras can be converted for use in conjunction with compound microscopes for high power work.

Code Word	Cat. No.	Designation	Price
UFOXV	**22719a**	**Stereo Camera, "Macca",** with time and instantaneous shutter and wire release, **two plate holders** for plates **1¾x2⅜ in.,** one ground glass screen, **in case**	$
UFOYW	**22721a**	**Stereo Camera, "Macca",** same as above, **but supplied with filmpack adapter** in place of plate holders	
UGUBA	**22730a**	**Stereo Camera, "Makam",** with time and instantaneous shutter and wire release, **two plate holders** for plates **3¼x4¼ in.,** one ground glass screen, **in case**	
UGUCH	**22732a**	**Stereo Camera, "Makam",** same as above, **but supplied with filmpack adapter** in place of plate holders	
UGUDO	**32200**	**Adapter,** to attach either of the above cameras to the binocular microscope "UBM" **Note:** *To take* ***stereoscopic pictures*** *in connection with the binocular microscope "UBM",* ***two*** *(one pair) of either of the above cameras as well as* ***two*** *adapters (one pair) No. 32200 are required. (If it is desired to simply record the image of the binocular microscope without valuing the stereoscopic effect, it will prove sufficient to only use one single camera.)*	
UGUEP	**32210**	**"IBSO" Attachment,** consisting of total reflecting prism, focusable observation side-telescope with cross hairs, *"Periplan"* ocular 8X and wire release (*the latter permits to dislodge the prism which reflects the rays towards the observation telescope, to gain an increase of light during exposure*) **Note:** *Attaching the "IBSO" arrangement No. 32210 to either of the above cameras, they are readily converted for use with compound microscopes for high power work.*	

Note: 1) These attachment cameras can be used to the same advantage in connection with the binocular microscope "BSM" (*listed on pages 132-135*), as well as the *"Greenough-Leitz"* binocular microscopes (*listed on pages 146-152*).

2) When ordering the cameras for use with other binocular microscopes than "UBM," the model should be specified in the order.

NEW AND IMPROVED BINOCULAR MICROSCOPES

"Greenough" Pattern

The advantages of binocular vision are so obvious as to make their enumeration unnecessary. For years past its adaptation to microscopical vision has been attempted and since, several ingenious devices have been offered. The *"Greenough"* **Binocular Microscope**, however, has approached the solution of this problem in a more perfect manner than any other microscopical arrangement.

The *"Greenough-Leitz"* binocular microscope is provided with two prism bodies (two complete optical units), through which the paths of rays converge to a simultaneous focal point and in this manner objects (even those of small dimensions), **are revealed in true proportions**, unattainable with monocular (single tube) microscopes. This feature renders the *"Greenough-Leitz"* binocular microscope particularly suitable for a great variety of examinations; viz.,

In Biological Science: for anatomical specimens, plants, seeds, moulds, skin conditions, embryos, pathological gross specimens, insects and parts thereof, etc.

In Geology, Mineralogy, etc.: for micro-paleontology, fragmental material, mineral characters, porosity of minerals, replacement structures, inter-relations, relation of ore and gauge materials, textural relations, etc.

In Metallography: for metal surfaces, gross specimens, fractures, etc.

In General Engineering: for testing tools, structural relations, progress in manufacture, etc.

In Industrial and Commercial Laboratories: for leather, paper, fibres, textiles, seeds, moulds; for testing the progress of precision work during manufacture or to control the work after it has been completed, etc.

In Jewelers' Trade: for small crystals, precious stones, etc.

In fact, the *"Greenough-Leitz"* Binocular Microscope serves for the examination of any object requiring relatively high magnifications and a true condition of the specimen is revealed due to stereoscopic binocular vision.

Each tube is equipped with one pair of *"Porro"* prisms which act to erect the image instead of showing it inverted as prevails with standard monocular compound microscopes. This factor is of paramount importance particularly in dissecting work, since the instruments used for dissection are seen moving in their true direction (not reversed, as experienced with dissecting microscopes of other construction).

By means of an ingenious metal device, the prisms are mounted most securely so that under normal working conditions they are entirely immune against becoming loose or out of alignment. Consistent with the recognized precision workmanship of Leitz instruments, the prisms are made of highest quality hard glass, free from strain, the glass being of an absolute homogeneous consistency; the surfaces are perfectly polished, optically plane and at mathematically correct angles to each other.

The binocular tubes, being rotatable to their axes, afford a most convenient and at the same time precise adjustment for interpupillary distances. The range of this adjustment is fully sufficient to accommodate the most extreme interpupillary distances.

Universal Adaptability of the "Greenough-Leitz" Binocular Microscopes

Its new and improved construction has been arranged in such manner to likewise permit the use of

The Wide Angle, Low Power Objectives and Large Diameter Oculars of the Universal Binocular Microscope "UBM"

(The features of these optical units are described on pages 152-153)

By means of the wide angle, low power objectives and oculars of increased diameter, the *"Greenough-Leitz"* microscope is available for the examination of large specimens which require a long working distance. The wide angle objectives No. 32010 and 32015, in conjunction with the large diameter oculars Nos. 32060-32075, **completely cover large objects (in size up to 45mm) without the necessity of shifting the specimen.**

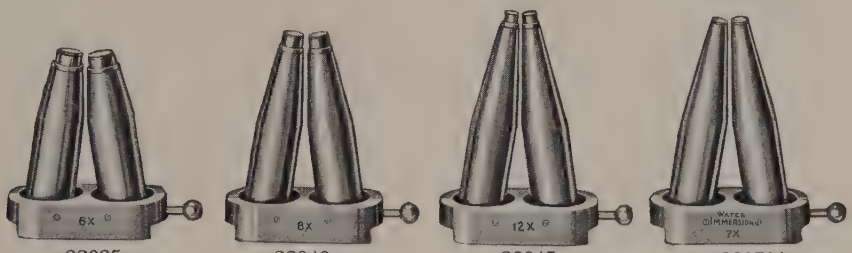
To permit the use of this important feature, the binocular bodies are provided with ocular tubes of large diameter, into which the oculars of normal size fit by means of an intermediate adapter. Removing this adapter, the oculars of large diameter can be inserted. The wide angle objectives are attached in place of the *"Greenough"* objectives. This is accomplished by removing the conical adapter from the binocular body and substituting in its place the wide angle objectives which are provided with an identical dove-tailed slider as prevails with the body adapter.
Note: For prices of the wide angle objectives and oculars of large diameter, refer to pages 152-153.)

(*Continued on page 147*)

"GREENOUGH-LEITZ" BINOCULAR MICROSCOPES—(Continued)

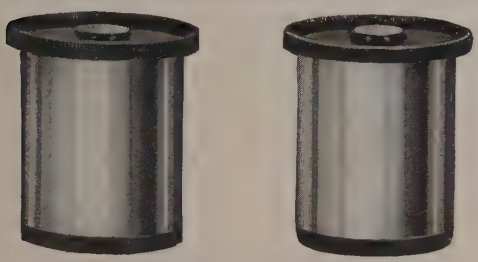
Paired Objectives for "Greenough-Leitz" Binocular Microscopes

Catalog No.:	32020	32025	32030
Price:	$	$	$
Initial Magnification, mm:	2X	3X	4X
Focal Length, mm:	55	46	40
Code Word:	UBAFI	UBAGA	UBAHO



Catalog No.:	32035	32040	32045	32050*
Price:	$	$	$	$
Initial Magnification, mm:	6X	8X	12X	7X
Focal Length, mm:	30	24	18	25
Code Word:	UBAIB	UBAJU	UBAKY	UBALP

** No. 32050 represents a water immersion objective.*



Paired Oculars for "Greenough-Leitz" Binocular Microscopes

These oculars are carefully matched so as to coincide perfectly with each other in respect to their optical characteristics. As a result they are guaranteed to afford absolute freedom from eye-strain. Each pair of oculars has one of them adjustable to compensate for any difference in the eyes of the observer.

Prices and Optical Characteristics of Paired Oculars

	"Huyghenian" Type						*"Periplan"* Type	
Catalog No.:	**22038b**	**22040b**	**22042b**	**22044b**	**22046b**	**22048b**	**22075b**	**22077b**
Code Word:	GINUB	GIGEB	GIZWB	GIDRB	GIVYB	GIFUB	GIZUB	GIZAB
Magnifying Power:	**4X**	**5X**	**6X**	**8X**	**10X**	**12X**	**15X**	**20X**
Focal Length, mm:	62	50	42	31	25	21	16.5	12.5
Price: $								

Table of Magnifications and Optical Characteristics of Objectives and Oculars of the "Greenough-Leitz" Binocular Microscope

			"Huyghenian" Oculars						*"Periplan"* Oculars	
Catalog No.:			**22038b**	**22040b**	**22042b**	**22044b**	**22046b**	**22048b**	**22075b**	**22077b**
Designation:			**4X**	**5X**	**6X**	**8X**	**10X**	**12X**	**15X**	**20X**
Objectives			Combined Magnification							
Cat. No.	**Designation**	Focal Length mm								
32020	**2X**	55	8	10	12	16	20	24	30	40
32025	**3X**	46	12	15	18	24	30	36	45	60
32030	**4X**	40	16	20	24	32	40	48	60	80
32035	**6X**	30	24	30	36	48	60	72	90	120
32040	**8X**	24	32	40	48	64	80	96	120	160
32045	**12X**	18	48	60	72	96	120	144	180	240
32050	**7X***	25	28	35	42	56	70	84	105	140

** The paired objectives 7X represent a water immersion.*

(Continued on page 148)

"GREENOUGH-LEITZ" BINOCULAR MICROSCOPES—(Continued)

Optical Equipments for "Greenough-Leitz" Binocular Microscope

With each *"Greenough-Leitz"* binocular microscope we list **four** different optical equipments, which, due to their assortment, will serve varying requirements.

Optical Equipment No. 1 covers a restricted outfit for comparatively low power work only. (*Magnification: 24-40X*)

Optical Equipment No. 3 offers a somewhat wider range of application than No. 1. (*Magnification: 18-90X*)

Optical Equipment No. 5 constitutes a more complete assortment of optics, ranging from low to higher power; it will consequently serve in a rather far-reaching manner for a variety of tests. (*Magnification: 10-160X*)

Optical Equipment No. 7 covers the complete series of paired objectives and oculars, as described on page 147, and **thereby affords a wide range of application under low as well as medium and high magnifications; it represents a very popular assortment.** (*Magnification: 8-240X*)

Inasmuch as each stand is likewise listed without optics, any desired equipment can easily be selected to meet all existing requirements. The table on page 147 enumerates all the magnifications obtainable with the various combinations of objectives and oculars, enabling to judge which optics are required dependent upon the magnifications desired. **Even if in the beginning an instrument is ordered with a small equipment, additional objectives and oculars can be ordered at any later time since all the optics of the** *"Greenough-Leitz"* **binocular microscopes are interchangeable.**

As guide towards selecting a complete equipment varying from those enumerated in conjunction with each microscope stand, we give the following example:

Stand proper, as designated by the figure "40" with each microscope (*listed on pages 149-151*).

Paired Objectives, to be selected from Nos. 32020-32050 (*listed on page 147*).

Paired Oculars, to be selected from Nos. 22038b-22077b (*listed on page 147*).

We do not wish to overlook drawing your attention to the **additional paired objectives and oculars for wide angle field observation under low power** (*listed on pages 152-153*). These items can likewise be added to the *"Greenough-Leitz"* binocular microscopes and in respect to their value for special work, the description on pages 152-153 will give all the required details.

Note: If we are made familiar with the individual requirements that the *"Greenough-Leitz"* binocular microscope should meet, we will be pleased to offer our suggestions towards an appropriate equipment for selection.

Illuminants for "Greenough-Leitz" Binocular Microscopes

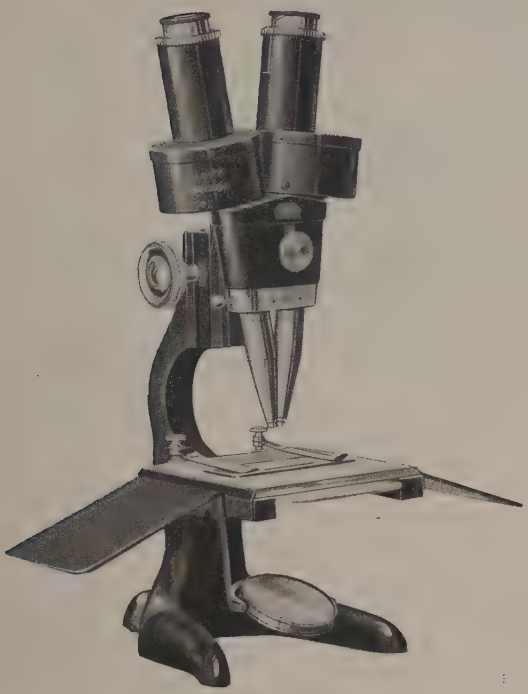
For the examination of opaque objects of any character, we offer suitable lamps which by means of holders are attached to the rack and pinion slider. Either one or two lamps can be utilized to illuminate the area beneath the objectives.

Note: For use with the *"Greenough-Leitz"* binocular microscopes the very same illuminants are available as are illustrated and described in connection with microscopes "BSM" on page 135, from which please make your selection.

The **attachment cameras** listed under Nos. 22719a-22732a (*page 145*) can be used advantageously in connection with the *"Greenough-Leitz"* binocular microscopes.

(*Continued on page 149*)

"GREENOUGH-LEITZ" BINOCULAR MICROSCOPE "GUE"



Model "GUE"

In general design it compares with the standard type of microscope stand. Its construction is so arranged to meet the requirements for the examination of opaque as well as transparent objects. The stand consists of a heavy horseshoe base, handle arm with inclination joint, mirror with one surface plano and the other concave.

The stage measures 100 x 100mm and is provided with a thick glass plate serving as support for the specimen; beneath the plate the metal frame carries a groove to accommodate a ground glass plate, producing diffused light, while an additional plate, with one surface black and the other white, can be inserted in its place, the latter serving as background for dark and light objects, respectively.

The stage is equipped with one pair of stage clips and one pair of metal hand rests.

The binocular prism body with rack and pinion slider can be easily removed and attached to a low auxiliary stand No. "GUF-0," listed below and illustrated in connection with Model "GUF" on page 150. By means of this stand, the instrument can be directly placed on specimens too large to be accommodated by the microscope stage.

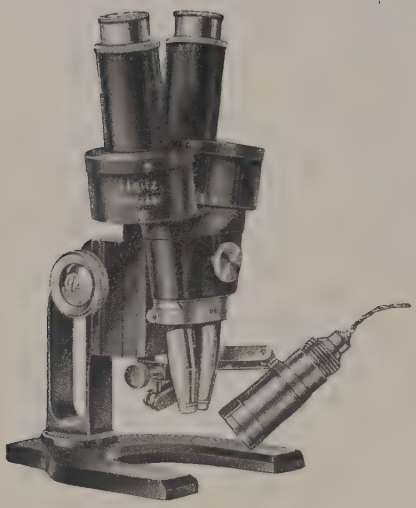
A hardwood cabinet, highly polished, provided with lock and key, is included with the prices listed.

The equipments enumerated below are to be regarded as suggestions of appropriately selected outfits. Substitutions in equipment may be made at will (in this respect we refer to page 148).

COMPLETE EQUIPMENTS:

Code Word	Cat. No.	Paired Objectives	Paired Oculars		Combined Magnification	Price
			"Huyghenian"	*"Periplan"*		
GENAP	**GUE-1**	40mm (4X)	6X, 10X	.....	24 – 40X	$
GENBY	**GUE-3**	46mm (3X), 30mm (6X)	6X, 10X	15X	18 – 90X	
GENCX	**GUE-5**	55mm (2X), 40mm (4X), 24mm (8X)	5X, 8X, 12X	20X	10 – 160X	
GENDZ	**GUE-7**	55mm (2X), 46mm (3X), 40mm (4X), 30mm (6X), 24mm (8X), 18mm (12X)	4X, 5X, 6X, 8X, 10X, 12X	15X, 20X	8 – 240X	
		SPECIAL EQUIPMENTS				
GENEB	**GUE-40**	***"Greenough-Leitz"* Binocular Microscope,** stand alone, including hand rests, **with** prism body "GU" and rack and pinion slider, **without** objectives, **without** oculars, **but in cabinet**.....				
GENFT	**GUE-42**	**Stand alone, without** prism body, **without** rack and pinion slider, **without** objectives, **without** oculars, **but in cabinet**..				
GENGH	**GUF-O**	**Auxiliary Stand,** consisting of hard rubber base with handle arm, as illustrated in connection with model "GUF" (page 150).....				
GENHO	**GU**	**Prism Body, without** stand, **without** rack and pinion slider, **without** objectives, **without** oculars, with fastening device to permit interchangeable attachment to the various stands				
UBACH	**32005**	**Rack and Pinion Slider,** for focusing of prism body upon the stand..... **Note:** If the hand rests are not desired, **deduct**.....				

"GREENOUGH-LEITZ" BINOCULAR MICROSCOPE "GUF"



Model "GUF"
Demonstrating one lamp attached

Model "GUF" represents the upper portion of the microscope "GUE" and consists of the binocular body tube "GU," attached to a special pillar stand, mounted on hard rubber base (GUF-42).

It is especially available for the examination of objects too large to be accommodated by the stage of stand "GUE," and the construction is such that the microscope can be directly placed upon the specimen itself, whenever required. Model "GUF" can be used for the examination of specimens in sealed jars, even under relatively high magnifications. It is furthermore employed to advantage for testing wood, paper, leather, metals, ores, minerals and many more large objects, offering in connection with these investigations a bright stereoscopic image at a field of view of exceedingly wide area.

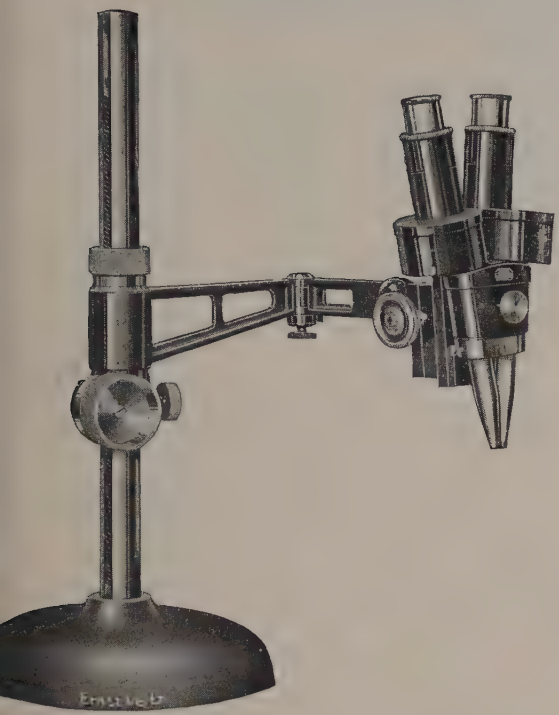
COMPLETE EQUIPMENTS:

Code Word	Cat. No.	Paired Objectives	Paired Oculars		Combined Magnification	Price
			"Huyghenian"	*"Periplan"*		
GENIL	**GUF-1**	40mm (4X)	6X, 10X	.....	24 – 40X	$
GENKA	**GUF-3**	46mm (3X), 30mm (6X)	6X, 10X	15X	18 – 90X	
GENLS	**GUF-5**	55mm (2X), 40mm (4X), 24mm (8X)	5X, 8X, 12X	20X	10 – 160X	
GENOD	**GUF-7**	55mm (2X), 46mm (3X), 40mm (4X), 30mm (6X), 24mm (8X), 18mm (12X)	4X, 5X, 6X, 8X, 10X, 12X	15X, 20X	8 – 240X	

SPECIAL EQUIPMENTS:

GENPN	**GUF-40**	***"Greenough-Leitz"* Binocular Microscope,** stand alone, **with** prism body "GU" and rack and pinion slider, **without** objectives, **without** oculars, **but in cabinet**.....
GENYJ	**GUF-42**	**Stand alone, without** prism body, **without** rack and pinion slider, **without** objectives, **without** oculars, **but in cabinet**..
GENHO	**GU**	**Prism Body, without** stand, **without** rack and pinion slider, **without** objectives, **without** oculars, with fastening device to permit interchangeable attachment to the various stands.....
UBACH	**32005**	**Rack and Pinion Slider,** for focusing of prism body upon the stand.....

"GREENOUGH-LEITZ" BINOCULAR MICROSCOPE "GUG"



Model "GUG"

The stand "GUG" consists of a heavy iron base, attached thereto a vertical pillar of massive construction. A movable socket with strong pinion glides over the vertical pillar and affords a coarse movement and focus to the horizontal arm, which is mounted in such a manner as to rest upon the socket with pinion. The horizontal arm has an inclinable joint within the horizontal plane so as to permit examination of any part of the specimen. At its extreme end the horizontal arm carries a universal joint for orientation within the vertical and horizontal axis. To the universal joint is attached a dove-tailed slider with eccentric lever to accommodate the prism body "GU" and to lock it securely in place.

The model "GUG" affords a most universal application and orientation in all planes and directions, thereby making it most serviceable and offering the widest range of use. The prism body can be inclined to the proper plane of any specimen, regardless if mounted in a horizontal or vertical position.

COMPLETE EQUIPMENTS:

Code Word	Cat. No.	Paired Objectives	Paired Oculars		Combined Magnification	Price
			"Huyghenian"	*"Periplan"*		
GENRU	**GUG-1**	40mm (4X)	6X, 10X	.....	24 – 40X	$
GENSE	**GUG-3**	46mm (3X), 30mm (6X)	6X, 10X	15X	18 – 90X	
GENTV	**GUG-5**	55mm (2X), 40mm (3X), 24mm (8X)	5X, 8X, 12X	20X	10 – 160X	
GENUR	**GUG-7**	55mm (2X), 46mm (3X), 40mm (4X), 30mm (6X), 24mm (8X), 18mm (12X)	4X, 5X, 6X, 8X, 10X, 12X	15X, 20X	8 – 240X	

SPECIAL EQUIPMENTS:

GENVI	**GUG-40**	***"Greenough-Leitz"* Binocular Microscope,** stand alone, **with** prism body "GU" and rack and pinion slider, **without** objectives, **without** oculars, **without** cabinet.....
GENXK	**GUG-42**	**Stand alone, without** prism body, **without** rack and pinion slider, **without** objectives, **without** oculars, **without** cabinet..
GENGH	**GUF-O**	**Auxiliary Stand,** consisting of hard rubber base with handle arm, as illustrated in connection with model "GUF" (page 150)..... **Note:** *The binocular prism body with rack and pinion slider can be removed easily from stand "GUG" and attached to the low auxiliary stand "GUF-O". By means of this stand the instrument can be placed directly upon large specimens.*
GENHO	**GU**	**Prism Body, without** stand, **without** rack and pinion slider, **without** objectives, **without** oculars, with fastening device to permit interchangeable attachment to the various stands.....
UBACH	**32005**	**Rack and Pinion Slider,** for focusing of prism body upon the stand

WIDE ANGLE FEATURE

Applicable to the Various Models of "Greenough-Leitz" Microscopes

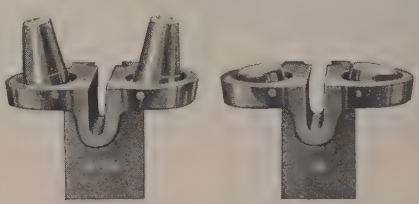
(listed in the foregoing)

The paired objectives of low power (0.75X and 1.0X) as well as the paired oculars of large diameter of **the Leitz Universal Binocular Microscope** can be utilized in conjunction with the *"Greenough-Leitz"* Microscopes. **The latter equipped with these additional optics offer most far-reaching means of application.**

The advantages of the low power (wide angle) feature are such that the extremely wide field permits the examination of extended areas under low magnifications and consequently **a large object is completely viewed without it being necessary to shift the specimen.** The usefulness is further increased through the long working distance of the objectives, permitting full advantage to be taken of the complete range of adjustments offered by the various mechanical stands, and furthermore, ample hand room is available for dissecting work.

The pronounced stereoscopic effect, which the *"Greenough-Leitz"* Microscopes render, is to the same extent perceivable with the objectives and oculars as referred to below. This feature combined with the large working distance of the objectives Nos. 32010 and 32015, as well as the wide field of the oculars Nos. 32060-32075, offer special advantages in dissecting work when the perception of three dimensions (width, depth, height) is a most essential factor. The high eyepoint of the oculars permits the use of customary eye-glasses.

PAIRED LOW POWER (wide angle) OBJECTIVES



Catalog No.:	32010	32015
Price:	$	$
Initial Magnification:	0.75X	1.0X
Focal Length, mm:	60	62
Code Word:	UBADT	UBAEF

The objectives 0.75X and 1.0X are provided with a dove-tailed track by means of which they are slid over the dove-tailed projection beneath the binocular body, after the intermediate adapter has been withdrawn, and in this manner the objectives rest tightly against the prism housing.

Due to the large lenses with which these objectives are equipped, the brilliancy of the image is increased by approximately 50%.

Note: The intermediate objective adapter is used only in conjunction with those objectives listed in connection with the *"Greenough-Leitz"* Microscopes and this adapter is consequently to be withdrawn when the low power (wide angle) objectives 0.75X and 1.0X are made use of.

(Continued on page 153)

PAIRED OCULARS OF LARGE DIAMETER (WIDE FIELD OCULARS)

for "Greenough-Leitz" Binocular Microscopes

Catalog No.:	32060	32065	32070	32075
Price:	$	$	$	$
Initial Magnification: ...	5X	8X	12X	18X
Focal Length, mm:	50	31	20	14
Code Word:..	UBANE	UBAOD	UBAPX	UBARC

The above oculars are of high optical correction and designed in such manner as to completely cover the exceptionally large field rendered by the series of special wide-angle objectives. The oculars measure 30mm in diameter and are corrected for chromatic aberration as well as for curvature of field and possess a high eye-point to permit the convenient use of spectacles. Each pair of oculars has one of them adjustable to compensate for any difference in the eyes of the observer.

Note: For reasons that the ocular tubes of the binocular body of the *"Greenough-Leitz"* Binocular Microscope are of large diameter, an adapter ring is furnished by means of which the oculars of ordinary diameter, with which the *"Greenough-Leitz"* Binocular Microscopes are regularly equipped, are rigidly held in place, truly aligned to the optical center. **These adapters will have to be removed when the oculars of large diameter Nos. 32060-32075 are used.**

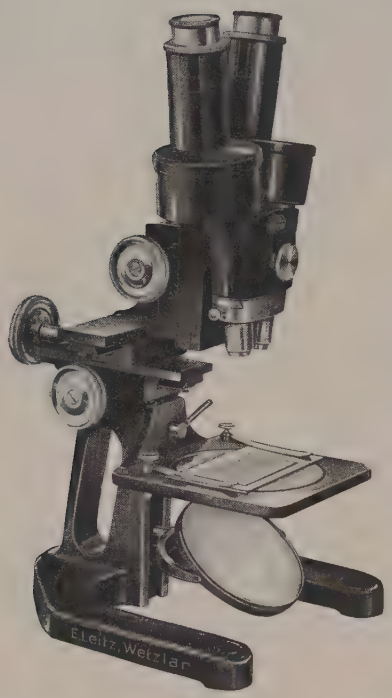
Table of Magnifications and Optical Characteristics of Objectives and Oculars offered for the wide-angle feature

				OCULARS							
Catalog No.:				**32060**		**32065**		**32070**		**32075**	
Designation:				**5X**		**8X**		**12X**		**18X**	
OBJECTIVES:											
Cat. No.	Designation	Focal Length mm	Working Distance mm	Magnification	Field of view mm	Magnification	Field of view mm	Magnification	Field of view mm	Magnification	Field of view mm
32010	**0.75X**	60	120	4	45	6	30	9	24	14	16
32015	**1.0X**	62	120	5	30	8	23	12	18	18	12

Note: The features of the wide-angle field are described in detail on page 136, in connection with the Leitz Universal Binocular Microscopes Model "UBM."

SPECIAL STAND "BMC"

for use with binocular bodies of microscopes "BSM" (*listed on page 134*) and "UBM" (*listed on page 136*) as well as the respective objectives and oculars available for these binocular bodies.



Even with the large range of mechanical stands we offer for use with the binocular microscopes "BSM" and "UBM," the need has made itself felt to have available a special stand with multiple adjustments affording a systematic movement of the binocular tube towards the object. To satisfy this demand, the special stand model "BMC" has been created. It consists essentially of a horseshoe base of large dimensions of which the pillar with handle forms an integral part. The pillar carries a sledge movement consisting of two racks and pinions affording a side and forward displacement of the microscope tube within ratios of 50mm at right angles to each other. The stage as well as mirror, both being of large dimensions, are removable from the dove-tailed track so as to enable objects of extensive size being placed between the foot in order to be directly examined. The mirror has one plano reflecting, and one opaque glass surface. The stage can furthermore be clamped within the dove-tailed track at any desired position. It is provided with a large opening for the reception of either a metal or glass plate, both being included in the equipment.

In order that this special stand may be equipped with the features of the binocular microscope **"BSM,"** the following items are required:

Rack and pinion slider No. 22104 (*listed on page 134*).

Binocular body, either No. 22100 or 22102 (*listed on page 134*).

Selection of **paired oculars** Nos. 22106-22111 (*listed on page 134*).

If it is desired to have the special stand "BMC" available with the optical features of the binocular microscope **"UBM,"** the following items are required:

Focusing mechanism No. 32005 (*listed on page 136*).

Binocular body No. 32000 (*listed on page 136*).

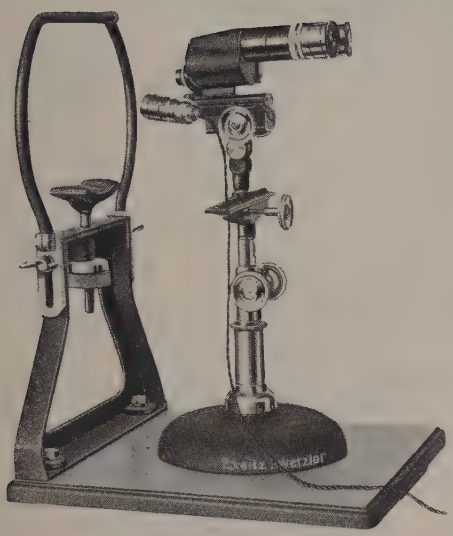
Objective adapter No. 32005 (*listed on page 137*) and this dependent upon the objectives desired.

A selection of the **paired objectives** Nos. 32010-32050 (*listed on page 137*).

A selection of the **paired oculars** Nos. 32060-32075 (*listed on page 138*).

Code Word	Cat. No.	Designation	Price
METOP	**22215**	**Special Stand "BMC"**, as described, **without** binocular body, objectives or oculars, **in case**	$

BINOCULAR CORNEAL MICROSCOPE "CLM"



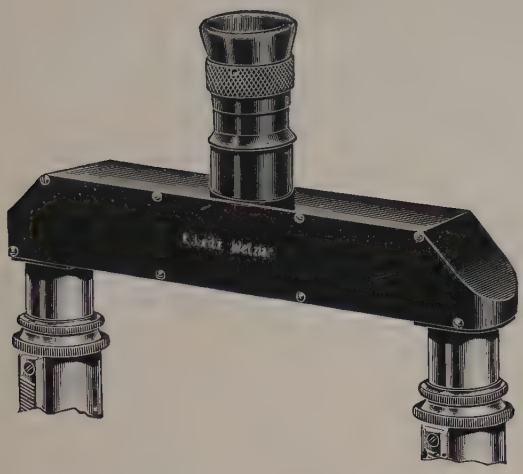
The corneal microscope "CLM" serves, as the name implies, as means of examining the eyes under stereoscopic vision. It consists of a frame serving as head and chin holder, mounted to an aluminum base plate, and essentially, of the microscope stand with binocular body supported by a round iron foot. The microscope stand is entirely independent of the head and chin holder and permits displacement upon the base plate so as to orient the microscope conveniently relative to the patient's position. Two rack and pinion motions controlling the forward and sideward movement of the binocular tube serve as focusing adjustment. The stand is furthermore equipped with a joint for tilting the microscope tube and has a swivel device by means of which the tube may be rotated about its axis. Aside from this far-reaching mode of orientation, the binocular tube may be moved backward and forward towards the eyes by means of a demountable focusing mechanism. To the rack and pinion casing of the microscope stand is attached an illuminant provided with a universal joint consisting of two members mounted to ball movements, affording an adjustment of the light rays at will. This illuminant is equipped with a lamp bulb 8-volt, 0.6 ampere; daylight as well as contrast filters are included in the equipment.

Code Word	Cat. No.	Designation	Price
LEDHJ	32600	**Binocular Corneal Microscope "CLM",** consisting of: Head and chin holder mounted to aluminum base plate; Microscope stand with two rack and pinion movements; Additional rack and pinion mechanism for focusing; Binocular body tube with stationary mounted objectives; One each pair of oculars "A-5", "A-10" and "A-15"; (*Magnification:* 10-30X) Illuminant mounted to ball-jointed arms, including Lamp 8-volt, 0.6 ampere; One each daylight and contrast filter; Complete with cord and plug	$
REKEY	32978	**Adjustable Rheostat,** combination model, for 110- and 220-volt with ammeter, available for D.C. and A.C.	
LISEY	32980	**Lamp bulb,** 8-volt, 0.6 ampere, for replacement	

Pages 157 to 185 cover

MICROSCOPE ACCESSORIES

COMPARISON OCULAR



The comparison ocular serves for comparing, by means of a single ocular, two specimens on the stage of two separate microscopes, situated side by side. The regulation type of microscope available in laboratories may be utilized, while it is essential that only objectives of identical focal lengths as well as magnifications and other optical properties are used. The comparison field obtained with this ocular is somewhat similar to the one rendered by the comparison microscope "COMP" (*listed on page 88*).

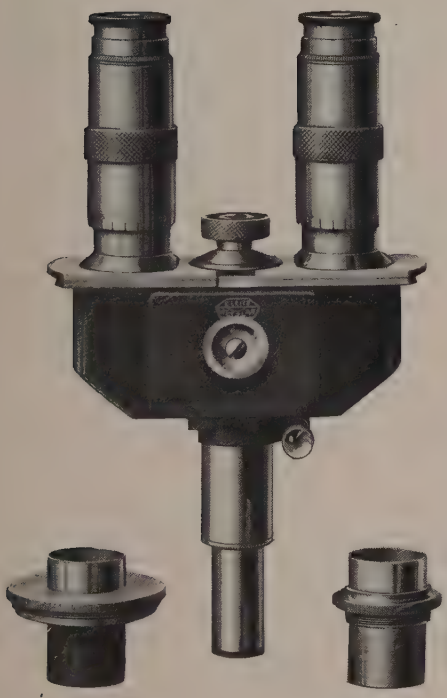
The comparison attachment consists of a prism housing with two tubes mounted thereto. These tubes slide into the draw tubes of the two microscopes.

On one of the microscopes utilized a normal (standard) specimen is placed, while the other microscope is to be equipped with the specimen to be compared, in order to determine the difference between these two preparations. Inasmuch as the two fields are situated side by side within the ocular such a comparison is easy and most reliable. The ocular, being equipped with a focusing collar, permits a sharp focus upon the dividing line within the field.

Code Word	Cat. No.	Designation	Price
CIFEP	**22695**	**Comparison Ocular,** as described, **in case**	$

BINOCULAR STEREO ATTACHMENT
rendering Stereoscopic and Erected Images

(*U. S. Patent No. 1,528,931*)



To facilitate binocular vision in connection with microscopes of monocular type, we offer the "Binocular Stereo Attachment" which is endowed with the same optical characteristics as the binocular tube of the "Mon-Objective" Binocular microscopes. The prism body supplied with two ocular tubes contains a system of prisms which divides the optical rays and reflects them equally to both eyes, utilizing the full aperture of the objectives. The rays are such that the tube length for both oculars is identical and consequently the magnification obtained in one tube is equal to the other.

After the draw tube has been removed from the microscope, the binocular stereo attachment is inserted and fastened by means of a screw sleeve. The two ocular tubes, by means of a rack and pinion, are adjustable to the correct interpupillary distance of the observer and the distance can be read off a millimeter scale. In case of a difference between the two eyes of the observer, correct focus can be obtained in the following manner: adjust focus for the right eye by means of the micrometer screw and then turn adjustment collar of left ocular tube until the field is equally sharp for both eyes.

Attached to a Leitz Microscope

The chief advantages of the attachment are as follows:

1. *It renders a specific stereoscopic effect even under the highest magnifications without sacrifice of definition inasmuch as the full numerical aperture of the objectives is maintained;*
2. *The image is erected, therefore the object appears in the same oriented position as it holds while resting upon the microscope stage;*

(*Continued on page 158*)

BINOCULAR STEREO ATTACHMENT—(Continued)

3. *When the stereo attachment is used, the magnification resulting from the objectives and oculars used* ***is identical to the magnification of the monocular microscope.***
   (*This is possible through the addition of a lens system situated within the lower tube of the stereo attachment.*)

Bearing in mind that other manufacturers likewise offer binocular attachments which, however, permit the use of low power oculars **only**, since through the increased tube length the magnification in itself increases proportionately and consequently a decrease in definition results, **one will readily appreciate the advantages offered with the new LEITZ BINOCULAR STEREO ATTACHMENT.**

The increased stereoscopic effect is obtained through a semi-circular diaphragm which by means of a knob at the front of the prism housing can be swung in and out of the optical rays. The diaphragm permits about one-half of the ocular circle to be screened. Through the application of such a device, the binocular stereo attachment represents the only instrument that **produces a stereoscopic effect even in conjunction with the highest magnification and this without the definition of the objectives being reduced.**

After the attachment has been inserted into the tube of the monocular microscope, the diaphragm is to remain outside of the optical rays, both oculars being adjusted to identical height, steps are taken towards focusing the object, this being best accomplished by using one eye. In manipulating the rack and pinion movement situated between the two ocular tubes, the oculars are adjusted to correct interpupillary distance which can be accomplished most efficiently by alternately closing both eyes maintaining at the same time a rigid position of the head and by adjusting the distance between the two ocular tubes continuously until the field of view can be completely and easily seen with both eyes. After the correct interpupillary distance has once been determined, it can be recorded by means of the scale and vernier with which the rack and pinion movement controlling the distance between the ocular tubes is equipped.

Having accomplished what is suggested above, the microscope is ready for use. To produce a specific stereoscopic effect, the diaphragm is now swung into place by means of the knob at the front of the prism housing and in order to observe the position of the diaphragm, it is best to remove the ocular at the right. It is by no means essential to insert the diaphragm completely since a stereoscopic effect is in most instances already noticeable after the diaphragm has been inserted slightly. In changing the position of the diaphragm, the stereoscopic effect can be suitably stimulated according to the nature of the specimens used.

If, after the diaphragm has been inserted, and in moving the head sidewards above the ocular tube from which the ocular has been removed, one notices that the diaphragm reduces in size, then a parallaxis exists between the effective aperture diaphragm of the objective and the semi-circular diaphragm. The parallaxis can be rectified through a slight turn at the diaphragm knob and that this has been correctly accomplished is easily noticeable if the proportional size between the inserted semi-circular diaphragm and the visible objective opening (approximately one-half) remains unchanged.

The binocular stereo attachment permits stereo-photo-micrograms to be taken at only one exposure.

(*It should not be overlooked that in order to obtain true stereoscopic effect, the underlying principles on which such an effect depends will have to be in evidence. These principles are:*

1. *That preparations with noticeable depth should be used;*
2. *That the observer's eyes should be normally susceptible to specific stereoscopic impressions which in many cases can be successfully increased through proper training. Observers wearing eyeglasses, particularly those with greatly differing eyes, will do well to use their spectacles or make provision for suitable glasses to be attached to the oculars. In case of a slight variation between the observer's eyes, oculars with adjustable eye lenses can be furnished upon request.*)

If the binocular stereo attachment is to be used with achromatic and fluorite objectives, we recommend *"Huyghenian"* oculars, and for apochromatic objectives, *"Periplan"* oculars.

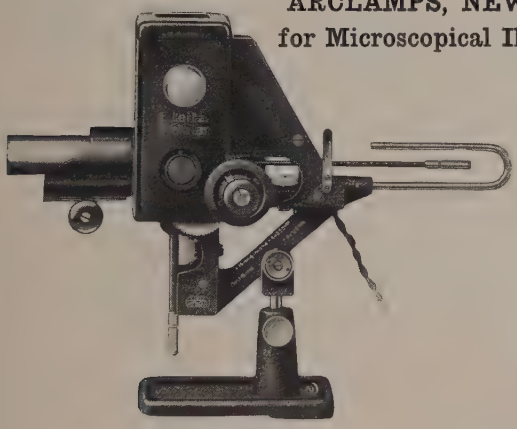
Note: Since the tube varies in dimensions not only with Leitz microscopes but also with those of other manufacture, we suggest that when placing an order for the binocular stereo attachment, the draw tube of the microscope with which it is to be used as well as the adapter be forwarded to us so that we can supply the correct screw adapter to fit the microscope involved, this adapter to serve as sleeve for the binocular stereo attachment to glide into. In this way, the binocular stereo attachment will readily adapt itself to the available microscope.

(*Continued on page 159*)

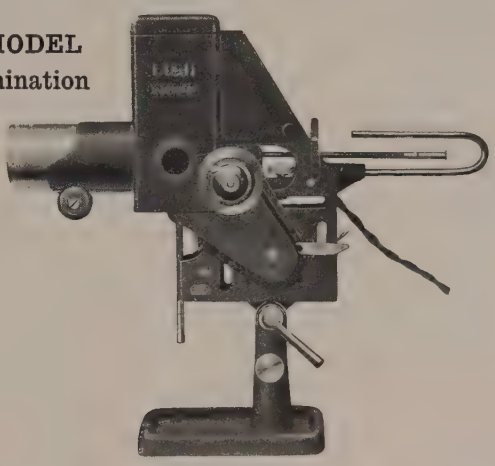
BINOCULAR STEREO ATTACHMENT—(Continued)

Code Word	Cat. No.	Designation	Price
ALBXM	**22700**	**Binocular Stereo Attachment,** stereoscopic and image erecting, as described, with one screw ring for Leitz microscopes but without oculars, **in case**	$
ALBYD	**22700a**	**Screw Ring,** for other than Leitz microscopes	
GINUL	**22038a**	**Pair of matched** "*Huyghenian*" **oculars** 4X	
GIGEN	**22040a**	**Pair of matched** "*Huyghenian*" **oculars** 5X	
GIZWA	**22042a**	**Pair of matched** "*Huyghenian*" **oculars** 6X	
GIDRO	**22044a**	**Pair of matched** "*Huyghenian*" **oculars** 8X	
GIVYR	**22046a**	**Pair of matched** "*Huyghenian*" **oculars** 10X	
GIFUN	**22048a**	**Pair of matched** "*Huyghenian*" **oculars** 12X	
GAFUL	**22065a**	**Pair of matched** "*Periplan*" **oculars** 4X	
GAFEN	**22066a**	**Pair of matched** "*Periplan*" **oculars** 5X	
GAFWA	**22067a**	**Pair of matched** "*Periplan*" **oculars** 6X	
GAFRE	**22069a**	**Pair of matched** "*Periplan*" **oculars** 8X	
GEPIR	**22071a**	**Pair of matched** "*Periplan*" **oculars** 10X	
GAPUN	**22073a**	**Pair of matched** "*Periplan*" **oculars** 12X	
GIZUR	**22075a**	**Pair of matched** "*Periplan*" **oculars** 15X	
GIZAS	**22077a**	**Pair of matched** "*Periplan*" **oculars** 20X	
GARIT	**22079a**	**Pair of matched** "*Periplan*" **oculars** 25X	

ARCLAMPS, NEW MODEL
for Microscopical Illumination



No. 32625



No. 32645

With the new arclamp the carbons do not need to be reset within the carbon holder as is the case with the previous model inasmuch as in the new type **the carbons burn completely down to the end.** A small metal sleeve is attached to the end of the carbon and after complete consumption of the carbon this sleeve is made to rest against the feeding track and automatically disconnects the lamp. This novel feature brings with it an economy in the consumption of carbons and does not entail any waste.

On account of a precise feeding of the carbons over rollers having prismatic surfaces, another advantage results through smooth movement when adjusting the lamp. The insertion and removal of carbons is very easily accomplished since it is not required to touch the heated carbon holders as is the case with lamps of previous type. Each carbon may be adjusted individually for the purpose of regulating the crater properly. The new model arclamp permits the use of carbons of varying diameter. The carbons supplied burn for approximately one to one and one-half hours. The construction involved permits the use of longer carbons than was formerly possible whereby their burning time can be considerably prolonged.

A maximum amount of light intensity is readily evident for reasons that the smooth burning of the lamp precludes a direct crater image so frequently noticed with the previous model. The new lamp is available for connection to the standard light socket, while it is suggested however, to provide the socket with a ten-ampere fuse because the current capacity when starting the lamp equals approximately nine amperes while during continuous burning of the carbons approximately five to six amperes are consumed.

Note: The lamps are provided with an inclination joint, while a heavy clamp holds them rigidly in the oriented position. Attached to the inclination joint is a vertical rod which slides into the vertical upright of the foot and by means of a clamping screw, the lamp can be conveniently raised and lowered to the height desired. (*Continued on page 160*)

ARCLAMPS, NEW MODEL—(Continued)

Model I, is of **hand-feed pattern,** the carbons being fed by hand and this in accordance with their consumption.

Model II, is of **automatic-feed pattern,** regulating the carbons by a clockwork mechanism and this in accordance with their consumption; the clockwork movement is adjustable so as to regulate the feeding mechanism in a precise manner corresponding to the burning of the carbons.

(*Model II is in great favor for laboratory work due to the fact that the carbons do not require any attention for the reason that they are fed automatically.*)

Both lamps are adapted for microscope illumination whenever a strong and dependable source of light is required and they furthermore serve as an ideal illuminant for photo-micrography and for the examination under darkfield.

The lamps may be used on either direct or alternating current and are connected to the house circuit by interposing a rheostat as listed below. For direct current, a carbon 250 x 5mm is used at the positive pole (horizontal carbon) and 120 x 6mm at the negative pole (vertical carbon); for alternating current, a carbon 250 x 4.5mm is placed in the horizontal holder and 120 x 7mm in the vertical holder.

Code Word	Cat. No.	Designation	Price
LEDJO	**32625**	**New Arclamp,** *Model I,* **hand-feed pattern,** as described, with illuminating lens **focusable by rack and pinion,** 15 ft. cord and plug, **without rheostat**	$
LEDLX	**32635**	**Ditto,** but illuminating lens of **"U-V" Crown glass, focusable by rack and pinion**	
LEDME	**32640**	**Ditto,** but illuminating lens of **quartz, focusable by rack and pinion**	
LEDNL	**32645**	**New Arclamp,** *Model II,* **automatic-feed pattern,** as described—clockwork movement for the carbons—with illuminating lens **focusable by rack and pinion,** 15 ft. cord and plug, **without rheostat**	
LEDPI	**32655**	**Ditto,** but illuminating lens of **"U-V" Crown glass, focusable by rack and pinion**	
LEDRG	**32660**	**Ditto,** but illuminating lens of **quartz, focusable by rack and pinion**	
RACTU	**32665**	**Rheostat,** 110-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**)	
RACUP	**32670**	**Rheostat,** 220-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**)	
RACVR	**32675**	**Carbon,** 250x5mm (horizontal) for **D.C.**	**per ten**
RACWO	**32680**	**Carbon,** 120x6mm (vertical) for **D.C.**	**per ten**
RACYX	**32685**	**Carbon,** 250x4.5mm (horizontal) for **A.C.**	**per ten**
RACZY	**32690**	**Carbon,** 120x7mm (vertical) for **A.C.**	**per ten**

Note: In order to assure a satisfactory performance of these lamps, we suggest ordering carbons supplied by us and storing these in a dry place.

ARCLAMPS

for Microscopical Illumination

No. 32700

No. 32720

These arclamps being designed for use with the microscope, are in great favor due to their convenient size and reliable construction. We offer these lamps in two types; viz.,

Model I, of **hand-feed pattern,** regulating the carbons by hand in accordance with their consumption; this adjustment being carried out by a rack and pinion movement.

Model II, of **automatic-feed pattern,** regulating the carbons by a clockwork movement in accordance with their consumption; the clockwork movement permits an adjustment of the carbon-feed.

(Model II is in great favor for laboratory work due to the fact that the carbons do not require any attention inasmuch as they are fed automatically.)

These lamps are supplied with an illuminating lens, mounted in sleeve for focusing, which enables concentrating the illuminating rays as may be desired.

Both lamps are adapted in a universal manner for microscope illumination, whenever a strong source of light is required and furthermore serve as an ideal illuminant for photo-micrography and examination under darkfield. The lamps are mounted to a heavy iron foot in which they can be adjusted to height and in addition thereto a clamping device serves to tilt the lamps to proper position towards the microscope mirror.

The lamps can be used on either direct or alternating current and are connected to any house circuit by interposing a rheostat to regulate the current. For direct current a carbon 150 x 8mm is used at the positive pole (horizontal carbon) and 150 x 6mm at the negative pole (vertical carbon), while for alternating current two carbons 150 x 7mm are used.

Code Word	Cat. No.	Designation	Price
LILAM	**32700**	**Arclamp,** *Model I,* **hand-feed pattern,** as described, with illuminating lens **in sliding mounting,** 15 ft. cord and plug, **without rheostat**	$
LIHAR	**32705**	**Ditto,** but illuminating lens **focusable by rack and pinion**	
LIULT	**32710**	**Ditto,** but illuminating lens of **"U-V" Crown glass, focusable by rack and pinion**	
LIART	**32715**	**Ditto,** but illuminating lens of **quartz, focusable by rack and pinion**	
LIUHR	**32720**	**Arclamp,** *Model II,* **automatic-feed pattern,** as described—clockwork movement for the carbons—with illuminating lens **in sliding mounting,** 15 ft. cord and plug, **without rheostat**	
LIZEN	**32725**	**Ditto,** but illuminating lens **focusable by rack and pinion**	
LIURK	**32730**	**Ditto,** but illuminating lens of **"U-V" Crown glass, focusable by rack and pinion**	
LIRAK	**32735**	**Ditto,** but illuminating lens of **quartz, focusable by rack and pinion**	
REARN	**32740**	**Rheostat,** 110-volt, 4-5 amperes	
REANA	**32745**	**Rheostat,** 220-volt, 4-5 amperes	
DABGI	**32750**	**Carbons,** 150x6mm **per 10**	
DABHR	**32755**	**Carbons,** 150x7mm **per 10**	
DABIL	**32760**	**Carbons,** 150x8mm **per 10**	

Note: In order to assure a satisfactory performance of these lamps, we suggest ordering carbons supplied by us and storing these in a dry place.

LEITZ SPECIAL LAMP

for Microscopical Observations, Darkfield Work and Photo-Micrography

This source of light represents a powerful incandescent lamp equipped with "Nitra" bulb 6-volt, 5-ampere. It replaces in an effective manner arclamps and represents a construction most convenient to use. Lamp No. 32800 consists of a housing, black lacquered, fastened to a vertical upright with foot by means of a cross-jointed clamp, permitting the lamp housing to be conveniently tilted and oriented so as to serve for illuminating the mirror of the microscope substage. By raising it sufficiently, it serves to illuminate either the entrance tube of vertical illuminators or directly opaque specimens placed on the microscope stage.

The cylindrical tube carries a condensing lens, focused by means of a spiral screw device. The lamp bulb is attached to a centering socket, enabling the lamp filament to be correctly oriented for a maximum light efficiency. Lamp No. 32800 may be attached to any light circuit.

Due to its high intrinsic light value, the lamp is furthermore admirably adapted for darkfield work and photo-micrography, for which a strong source of light is naturally required.

The lamp, furthermore, is adapted for producing monochromatic light within specific values of the spectrum. This is accomplished through the use of special filters and by the means of an adjustable rheostat or transformer, **supplied with ammeter.** The ammeter serves the purpose of feeding the lamp with specific current values, which jointly with the special filters create a light effect within definite spectral curves; viz.,

Rheostat or transformer adjusted to 4½-5 amperes, using filter No. 215, equals: line "C" of the Fraunhofer's curve;

Rheostat or transformer adjusted to 4⅕-5 amperes, using filter No. 395, equals: line "D" of the Fraunhofer's curve;

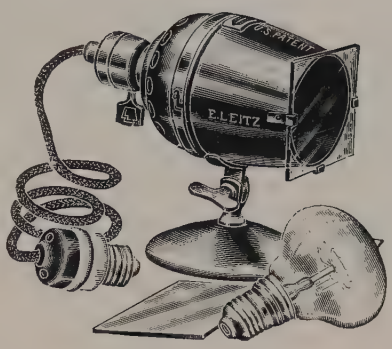
Rheostat or transformer adjusted to 5-6 amperes, using combination filter No. 370+391, equals: line "F" of the Fraunhofer's curve.

Such an arrangement is of eminent advantage in polarizing microscopic work and measurements as well as photo-micrography.

Code Word	Cat. No.	Designation	Price
MONLA	**32800**	**Leitz Special Microscope Lamp,** consisting of stand, housing, "Nitra" lamp bulb, 6-volt, 5-ampere, collimator illuminating system, complete as described, **without** filter, rheostat or transformer..... **Note:** *Above lamp is to be used with rheostat or transformer, dependent upon current conditions, and if the lamp is desired as* ***general microscope illuminant*** *without attaching special importance to specific spectral values of light, selection should be made from the following items:*	$
IFLIF	**32805**	**Filter Stand,** to hold filters Nos. 32810, 32815, 32816 and 32817.....	
IFTAG	**32810**	**Special Filter** *"Lifa"* No. 1658/26 (**for daylight**).....	
REDIG	**32855**	**Rheostat,** stationary, for "Nitra" lamp on **110**-volt **D.C.**.....	
REDUK	**32860**	**Rheostat,** stationary, for "Nitra" lamp on **220**-volt **D.C.**.....	
BYSFI	**32865**	**Transformer,** stationary, for "Nitra" lamp on **110**-volt **A.C.**.....	
BYSGO	**32870**	**Transformer,** stationary, for "Nitra" lamp on **220**-volt **A.C.**.....	
LINID	**32875**	**"Nitra" Lamp Bulb,** 6-volt, 5-ampere..... **Note:** *The following rheostats or transformers, dependent upon current conditions, together with special filters are required if the lamp* ***is to be used for monochromatic light*** *under specific spectral values.*	
REKUR	**32880**	**Adjustable Rheostat, with ammeter,** for "Nitra" lamp on **110**-volt **D.C.**	
REGAM	**32885**	**Adjustable Rheostat, with ammeter,** for "Nitra" lamp on **220**-volt **D.C.**	
REDYX	**32890**	**Adjustable Transformer, with ammeter,** for "Nitra" lamp on **110** to **220**-volt **A.C.**.....	
IFACE	**32815**	**Filter** *"Lifa"* **No. 215** (for line "C").....	
IFADA	**32816**	**Filter** *"Lifa"* **No. 395** (for line "D").....	
IFOEF	**32817**	**Filter** *"Lifa"* **No. 370 + 391** (for line "F")..... *(Nos. 32805 and 32810 can likewise be used when applying rheostats Nos. 32880 and 32885 or transformer No. 32890.)* If the Collimator Illuminating System of lamp No. 32800 is to be supplied with rack and pinion for focusing in place of spiral screw, **add to price** ***and add "MONUR"*** *to code word*.....	

MICROSCOPE LAMPS "RADIO"

(U. S. Patent No. 48588)



These lamps are of a rigid and durable construction and looked upon as a very efficient microscopical lamp of incandescent type. The concentrated filament of the "Radio" globe throws the entire light to the front towards the microscope mirror. This globe is furnished in 40-watt and offers an increase of 50% C. P. on the mirror of the microscope as compared with other lamps of the same wattage. The lamps, Models II and III, are supplied with a nitrogen lamp bulb of high intensity, having a strength of 100-watts. The housing is of copper, nickel-plated and highly polished. It does not obstruct, as its extreme height is only 6¼ in. No light escapes the housing to cause irritation of the eyes. Sufficient ventilation is provided for, to allow a current of air to surround the globe constantly and thereby prolonging its life. The stand is furnished with an inclination joint for tilting the lamp conveniently.

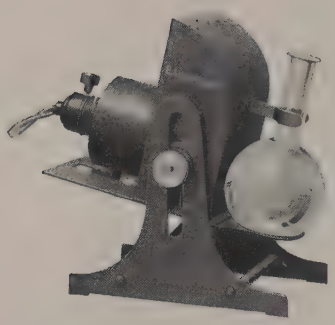
The "Radio" lamp offers artificial daylight by the aid of "Daylite" glass. Lamps Nos. 3865, 3885, 3895, 3905 and 3915, in place of ordinary blue and ground filters have a ground **Corning "Daylite"** glass filter.*

The "Radio" lamps feature a convertible pattern, which is unique in design and looked upon as a very satisfactory source of illumination for the microscope. We offer these lamps in three models:

I—For regular microscope illumination, **with bulb of 40-watts.**
II—For darkfield illumination, **with bulb of 100-watts.**
III—Combination model for regular microscopic and darkfield illumination, **with one each bulb of 40- and 100-watts.**

Code Word	Cat. No.	Designation	Price
		Model I—For Regular Microscope Illumination	$
COBYB	**3860**	**"Radio" Lamp,** with one each blue and white ground filter, cord and plug, **for 110-volt**	
COBZQ	**3865**	**"Radio" Lamp,** same as No. 3860 **but with "Daylite" filter,** for **110-volt**	
CIFRC	**3870**	**"Radio" Lamp,** same as No. 3860, but for **220-volt**	
CIFSE	**3875**	**"Radio" Lamp,** same as No. 3865, but for **220-volt**	
		Model II—For Darkfield Illumination	
CIFTN	**3880**	**"Radio" Lamp,** with one each blue and white ground filter, cord and plug, for **110-volt**	
CIFUK	**3885**	**"Radio" Lamp,** same as No. 3880, **but with "Daylite" filter,** for **110-volt**	
CIFVG	**3890**	**"Radio" Lamp,** same as No. 3880, but for **220-volt**	
CIFWH	**3895**	**"Radio" Lamp,** same as No. 3885, but for **220-volt**	
		Model III—Combination, for Regular Microscope and Darkfield Illumination	
CUDAX	**3900**	**"Radio" Lamp,** with one each blue and white ground filter, cord and plug, for **110-volt**	
CUDBY	**3905**	**"Radio" Lamp,** same as No. 3900 **but with "Daylite" filter,** for **110-volt**	
CUDCZ	**3910**	**"Radio" Lamp,** same as No. 3900, but for **220-volt**	
CUDDI	**3915**	**"Radio" Lamp,** same as No. 3905, but for **220-volt**	
CUDEK	**3920**	**"Radio" Globe,** 110-volt (for Nos. 3860-65, 3900-05)	
CUDFL	**3925**	**"Radio" Globe,** 220-volt (for Nos. 3870-75, 3910-15)	
CUDGA	**3930**	**"Radio" Nitrogen Globe,** 110-volt (for Nos. 3880-85, 3900-05)	
CUDHV	**3932**	**"Radio" Nitrogen Globe,** 220-volt (for Nos. 3890-95, 3910-15)	
DALIT	**3940**	**"Daylite" Filter,** for all lamps	
CUDJO	**3945**	**Blue Filter,** for all lamps	
CUDKP	**3950**	**White-Ground Filter,** for all lamps	

** Described by Professor Simon H. Gage in "Science," Oct. 15, 1915; pp. 534-6.*



MICROSCOPE LAMP "STELLA"

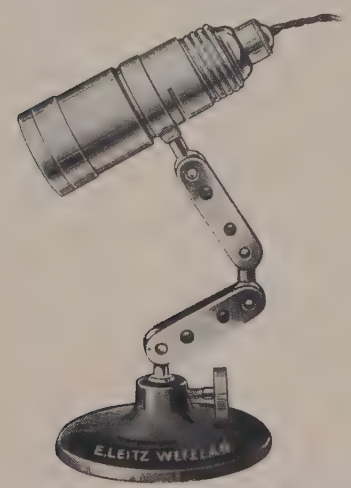
As the illustration implies, the lamp consists of a bulb mounted in a housing, the latter being held by pivoted screws to a supporting base on which it may be tilted at will. Two clamping screws serve to arrest the lamp in its inclined position. A flask is made to take the place of an illuminating lens and by means of this flask filled with water, an exceedingly strong and concentrated beam of light is obtained. The flask serves a three-fold purpose:

a) It acts as illuminating lens;
b) As cooling cell;
c) As solution filter.

Inasmuch as the flask is mounted to the lamp carriage, it is consequently tilted with the lamp and always retains its proper relative position towards the lamp bulb. The front of the flask is provided with a ground surface and the light passing through it is diffused.

We supply the "Stella" lamp with a bulb of either 100- or 250-watt. The lamp of 100-watt is usually employed for standard microscopical examination while if light of increased intensity is desired (for examination under darkfield, photo-micrography, etc.), the lamp of 250-watt should be preferred.

Code Word	Cat. No.	Designation	Price
STEBE	**32900**	**Microscope Lamp "Stella,"** complete as described, with **100-watt** filament bulb, condensing flask 300cc, 5 ft. cord and plug, for **110-volt**	$
SETAB	**32902**	**Microscope Lamp "Stella,"** same as No. 32900, but for **220-volt**	
STEDO	**32904**	**Microscope Lamp "Stella,"** complete as described, with **250-watt** filament bulb, condensing flask 300cc, 5 ft. cord and plug, for **110-volt**	
SETBO	**32906**	**Microscope Lamp "Stella,"** same as No. 32904, but for **220-volt**	
STIHU	**32908**	**Filament Bulb, 100-watt, 110-volt** (for replacement)	
SETCA	**32910**	**Filament Bulb, 100-watt, 220-volt** (for replacement)	
STIZA	**32912**	**Filament Bulb, 250-watt, 110-volt** (for replacement)	
SETDI	**32914**	**Filament Bulb, 250-watt, 220-volt** (for replacement)	
STOLP	**32916**	**Condensing Flask,** 300cc (for replacement)	



MINIATURE MICROSCOPE LAMP "MIGNON"

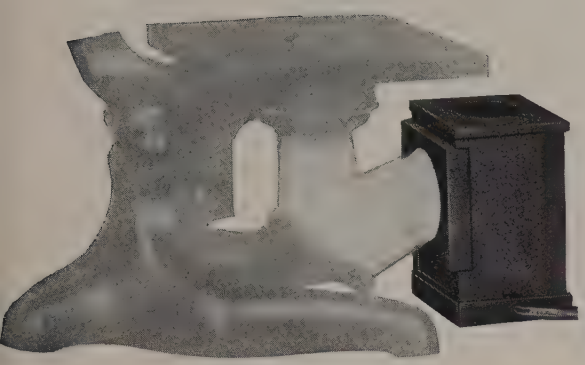
This lamp is an ideal illuminant of combination type for regular microscopic and darkfield illumination. It furthermore has other means of application; for instance, due to the ball-jointed links, it can be elevated in its height to illuminate opaque objects resting on the stage and furthermore withdrawing it from its supporting foot, it is made to serve as illuminant in connection with stereoscopic binocular microscopes by clamping the lamp, using a special adapter, to the rack and pinion casing. (*The "Mignon" lamp for use in connection with binocular microscopes is illustrated and described on page 135.*)

The lamp bulb 8-volt is of special design and renders an exceedingly strong and even beam of light. In front of the bulb is mounted an illuminating lens while the housing furthermore carries a slit for the insertion of one ground or one blue filter, these being supplied with the lamp.

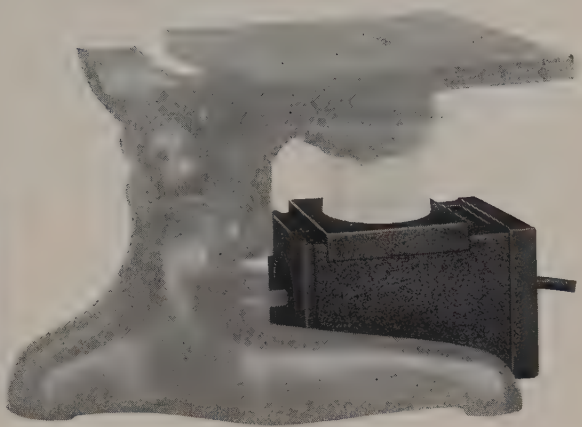
The "Mignon" lamp is of exceedingly small dimensions and can be used either in front of the mirror or made to pass beneath the substage condenser for direct illumination.

Code Word	Cat. No.	Designation	Price
DABLA	**22581**	**Microscope Lamp "Mignon,"** combination universal model, as described, with bulb 8-volt, illuminating lens, one each ground and blue glass filter, complete with cord, plug and one extra lamp bulb **Note:** *Either a rheostat or transformer should be selected for use with the above "Mignon" lamp, dependent upon the available current conditions, viz.:*	$
RACAQ	**32970**	**Rheostat, 110-volt, D.C.**	
RACBZ	**32972**	**Rheostat, 220-volt, D.C.**	
RACCH	**32974**	**Transformer, 110-volt, A.C.**	
RACDS	**32976**	**Transformer, 220-volt, A.C.**	
REKEY	**32978**	**Adjustable Rheostat,** combination model for **110-** and **220-volt,** with ammeter, available for **D.C.** and **A.C.**	
LISEY	**32980**	**Lamp Bulb,** 8-volt, 0.6 ampere	

MICROSCOPE SUBSTAGE LAMP "ELEI"



Used with microscope mirror

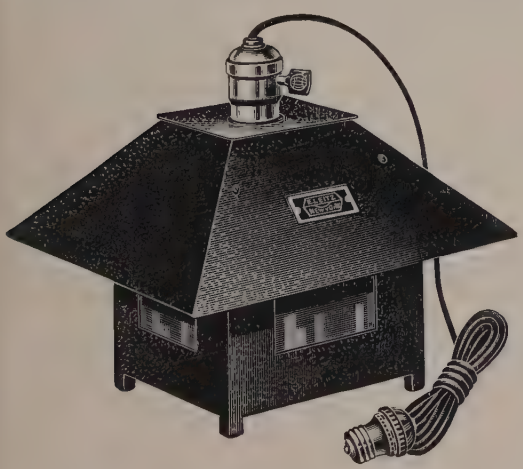


Used for direct illumination

The "Elei" substage lamp is of compact design and small enough to be placed between the foot of the microscope beneath the substage condenser for direct illumination, while at the same time it can be used with the microscope mirror if placed in front of same for indirect illumination. (This mode of application is shown in the above illustrations.)

In light intensity the "Elei" substage lamp is fully sufficient for ordinary microscope examination.

Code Word	Cat. No.	Designation	Price
DABOY	3840	**Substage Lamp "Elei,"** with one each blue and white ground filter, 6 ft. cord and plug, for **110-volt**	$
DABPE	3845	**Substage Lamp "Elei,"** with **Corning** *"Daylite"* **glass** in place of blue and white ground filters, 6 ft. cord and plug, for **110-volt**	
DABRX	3850	**Rheostat,** for use with either of the above lamps on **220-volt** circuit	
DABST	3855	**Lamp Bulb,** 15-watt, **110**-volt, for above lamps	



MICROSCOPE LAMP "CHALET"

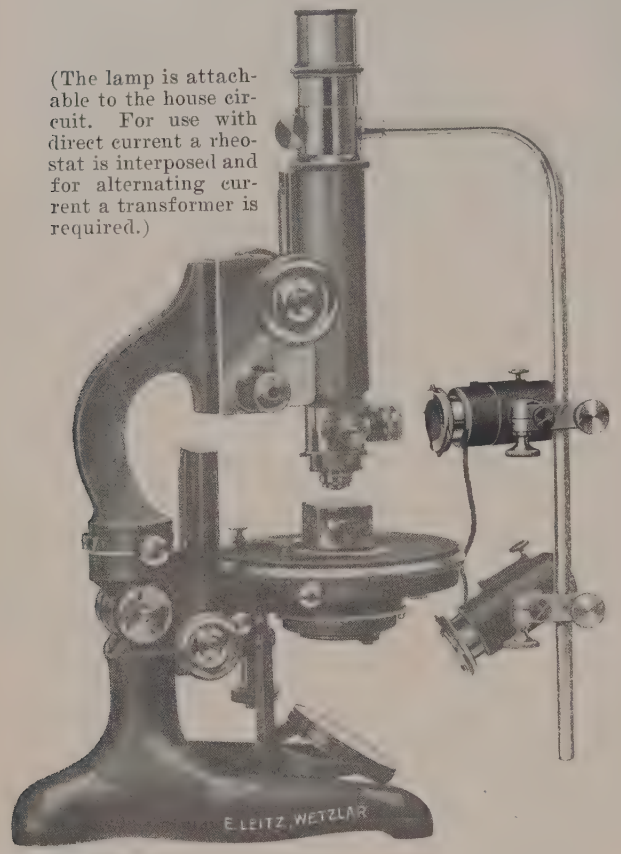
This lamp has been designed according to specifications of Prof. Simon H. Gage, Cornell University, and is constructed to serve one, two, three or four microscopes at one time. A 100-watt gas-filled *"Mazda"* bulb serves as illuminant and is mounted within a metal housing. The lamp bulb is sufficiently powerful for high magnifications. Being equipped with one or more Corning *"Daylite"* glass windows, 82mm square, the lamp renders an almost pure white light and true color values of stained specimens. The housing is screened so that no direct light reaches the eyes, however, the illumination is so arranged to allow sufficient light for making notes.

Code Word	Cat. No.	Designation	Price
CERFH	3966	**Microscope Lamp "Chalet,"** with **one** *"Daylite"* glass window, **110-volt**	$
CERGX	3966a	**Microscope Lamp "Chalet,"** same as No. 3966, but for **220-volt**	
CERHM	3967	**Microscope Lamp "Chalet,"** with **two** *"Daylite"* glass windows, **110-volt**	
CERIB	3967a	**Microscope Lamp "Chalet,"** same as No. 3967, but for **220-volt**	
CERJC	3968	**Microscope Lamp "Chalet,"** with four *"Daylite"* glass windows, **110-volt**	
CERKY	3968a	**Microscope Lamp "Chalet,"** same as No. 3968, but for **220-volt**	
CERLS	3969	**Lamp Bulb,** 100-watt, **110-volt,** *"Mazda"*	
CERMD	3969a	**Lamp Bulb,** 100-watt, **220-volt,** *"Mazda"*	

CONVERTIBLE MICROSCOPE LAMP

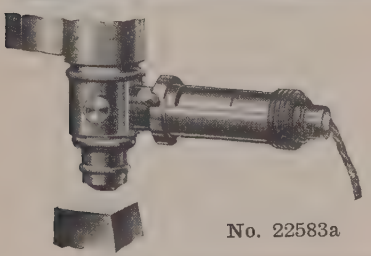
(For alternate use at the microscope mirror in case of trans-illumination and in conjunction with the vertical illuminator for the examination of opaque objects.)

This lamp consists of a housing in which is contained, within a centering mount, an 8-volt lamp bulb. A condensing lens situated in the tube of the housing, permits proper concentration of the light rays. A holder is attached to the front of the housing for the accommodation of ray filters. An elbow rod attaches to the microscope tube by means of a clamping device. The lamp housing glides on this rod and can be clamped thereon in any desired position for illumination in connection with vertical illuminators, the microscope mirror or substage, respectively, and for objects on the microscope stage.



(The lamp is attachable to the house circuit. For use with direct current a rheostat is interposed and for alternating current a transformer is required.)

Code Word	Cat. No.	Designation	Price
MIGNO	**22580**	**Convertible Microscope Lamp,** as described, complete with one extra lamp bulb 8-volt, one set of ray filters, cord and plug, **in case**. .	$
		Note: *Lamp No. 22580 is attachable to the house circuit. For use with this lamp either of the following rheostats or transformers, dependent upon the current conditions, is required:*	
RACAQ	**32970**	**Rheostat, 110**-volt, **D.C.**	
RACBZ	**32972**	**Rheostat, 220**-volt, **D.C.**	
RACCH	**32974**	**Transformer, 110**-volt, **A.C.**	
RACDS	**32976**	**Transformer, 220**-volt, **A.C.**	
REKEY	**32978**	**Adjustable Rheostat,** combination model, for **110**- and **220**-volt, with ammeter, available for **D.C.** and **A.C.**	
LISEY	**32980**	**Lamp Bulb,** 8-volt, 0.6 ampere	



No. 22583a

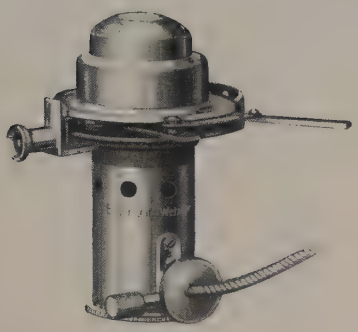
SPECIAL LAMP

(for use with Vertical Illuminators only)

This lamp is so constructed as to attach to the entrance tube of either vertical illuminators Nos. 22552 or 22556, by means of clamping screws. Being made a part of the vertical illuminator it thus moves up and down when focusing the objective and consequently the light remains always aligned and centered towards objective and opaque surface.

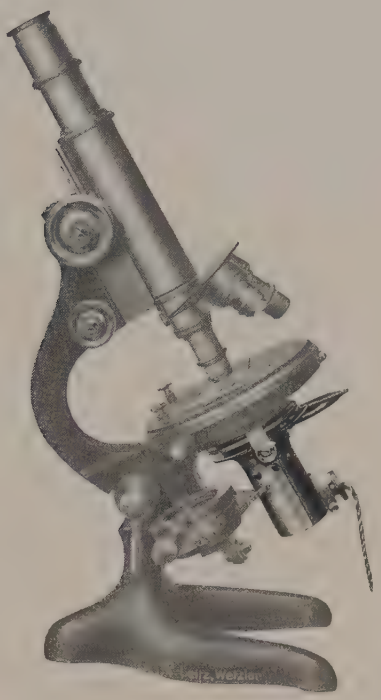
Code Word	Cat. No.	Designation	Price
MIGOL	**22583a**	**Special Lamp,** for vertical illuminator, as described, complete with one extra lamp bulb 8-volt, one set of ray filters, 6 ft. cord and plug, **in case**	$
		Note: *Lamp No. 22583a is attachable to the house circuit. For use with this lamp either of the following rheostats or transformers, dependent upon the current conditions, is required:*	
RACAQ	**32970**	**Rheostat, 110**-volt, **D.C.**	
RACBZ	**32972**	**Rheostat, 220**-volt, **D.C.**	
RACCH	**32974**	**Transformer, 110**-volt, **A.C.**	
RACDS	**32976**	**Transformer, 220**-volt, **A.C.**	
REKEY	**32978**	**Adjustable Rheostat,** combination model, for **110**- and **220**-volt, with ammeter, available for **D.C.** and **A.C.**	
LISEY	**32980**	**Lamp Bulb,** 8-volt, 0.6 ampere	

CONVERTIBLE SUBSTAGE LAMP



No. 22716

This lamp is constructed for interchangeable use with darkfield and standard substage condensers. For darkfield illumination it is clamped to the lower end of the darkfield condenser and likewise when using the standard condenser, it is fastened to it in a similar manner. If a microscope is equipped with substage condensers of different dimensions than those in which the substage appliances are now furnished, the combination lamp is likewise applicable by simply placing it between the foot of the microscope and having it so located that the illuminating rays proceed centrally towards the substage condenser. In the latter manner, the combination lamp is likewise usable with microscopes having no condenser.



No. 22716 attached to Microscope Condenser

The lamp bulb is of 8-volt type and sufficiently strong for illumination when oil immersion objectives are used or when applying it for darkfield work. The lamp housing is provided with a condenser lens controlling the proper concentration of the light rays. The lamp bulb is mounted to a centering socket. The combination lamp is equipped with one each ground and blue ray filter.

The current can be drawn from any lamp socket; for direct current a rheostat, and for alternating current a transformer is used.

Code Word	Cat. No.	Designation	Price
CEROV	**22716**	**Convertible Substage Lamp,** as described, 8-volt, complete with 6 ft. cord and plug as well as one each ground and blue ray filter, **in case**	$
CERRL	**22720**	**Convertible Substage Lamp** No. 22716 together with bi-centric darkfield condenser model "A" No. 22558 (*listed on pages 27-28*), **in case**	
DABCF	**22564**	**Objective Body with Funnel Stop** (used with oil immersion objectives to reduce them to proper numerical aperture for darkfield work).....	
IRTIS	**22564a**	**Objective Body with Iris Diaphragm** (this device should be given preference over No. 22564 for reasons that it permits the numerical aperture of objectives to be varied at will and consequently renders all objectives of high numerical aperture available for darkfield work)..	
RACAQ	**32970**	**Rheostat, 110**-volt, **D.C.**.....	
RACBZ	**32972**	**Rheostat, 220**-volt, **D.C.**.....	
RACCH	**32974**	**Transformer, 110**-volt, **A.C.**.....	
RACDS	**32976**	**Transformer, 220**-volt, **A.C.**.....	
REKEY	**32978**	**Adjustable Rheostat,** combination model, for **110**- and **220**-volt, with ammeter, available for **D.C.** and **A.C.**.....	
LISEY	**32980**	**Lamp Bulb,** 8-volt, 0.6-ampere.....	

Note: For the selection of accessories for darkfield illumination, we refer to page 29.

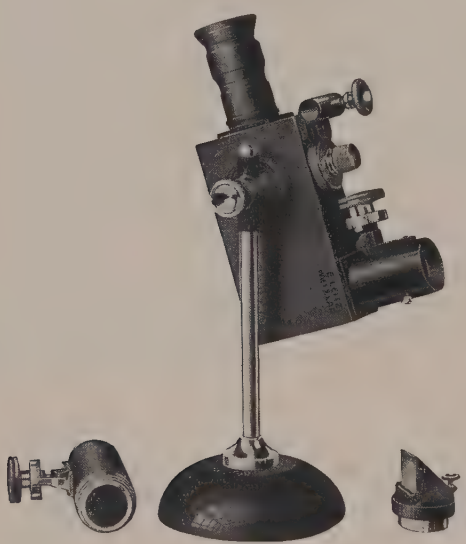
ILLUMINATING LENS
(Bull's-eye Condenser)

The lens is of plano-convex type, 100mm diameter, mounted to frame by pivoted screws for tilting. The arm, holding the frame, is attached to the vertical pillar of the iron foot by means of a universal joint through which the lens is afforded a movement in all directions and thereby easily oriented for any desired position relative to the source of light.

Code Word	Cat. No.	Designation	Price
CERWK	**22600**	**Illuminating Lens** — Bull's-eye Condenser — as described	$

MONOCHROMATOR

In its construction, the monochromator is so designed as to render it available for the illumination of the microscope with monochromatic light as well as for use for spectrum analysis of interference colors. This instrument can be utilized at the same time without the microscope for spectroscopic measurements. To accomplish the latter, the exit-slit with collimator lens unit may be replaced by an ocular with fiducial crosslines.



As a means of calibrating the spectrum, a helium tube is best suited for the reason that it furnishes a series of well defined lines spread over the entire spectrum. In the absence of a helium tube, the *"Bunsen"* flame should be colored successively with Li, Na and Tl. *A booklet of directions accompanies each monochromator and from it the correct means of calibration can be readily learned.*

When using the monochromator for spectroscopic work and examining flame spectra, absorption spectra, or measuring very fine lines, the monochromator is naturally employed independently of a microscope. **When utilizing the monochromator as a source of microscope illumination and employing it in connection with an arclamp** *(listed on pages 159-161)* **very efficient results are obtained.** The monochromator is applicable for microscope illumination both with and without microscope substage.

It is quite often very desirable to use monochromatic light in connection with polarizing (petrographical) microscopes and for this purpose the monochromator is ideally adapted. It can be applied to the examination under polarized light when viewing specimens orthoscopically and to the same advantage for conoscopic observation (interference figures).

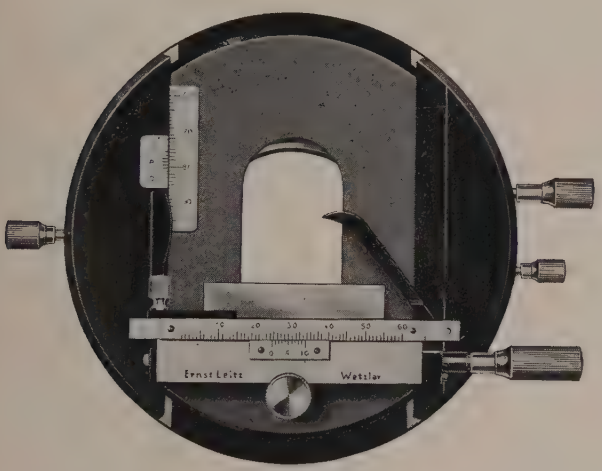
The booklet of directions accompanying each monochromator gives explicit details in respect to the use and adjustment of the instrument for the various modes of application referred to.

Code Word	Cat. No.	Designation	Price
CROMA	**2143**	**Monochromator,** as described, complete with all accessories for the various modes of application referred to above, **in case**	$

LIGHT FILTERS

For the purpose of obtaining a specific contrast in visual microscopical observation as well as photomicrography, light filters of a moderately restricted range of absorption should be utilized. These filters are introduced between the source of light of the microscope mirror or condenser. (On page 162 are listed color filters for special purposes such as photography by monochromatic light, etc.) In the following we recommend a series of filters which have proven highly efficient.

Code Word	Cat. No.	Designation	Price
IFGYN	**32820**	*"Lifa"* **Filter,** *yellow-green,* Grade No. 200b, represents a combination filter of yellow and green discs in mounting, adaptable to the state of correction of the objectives used—especially recommended for photo-micrography	$
IFBLA	**32822**	*"Lifa"* **Filter,** *blue,* Grade No. 201a	
IFGRU	**32824**	*"Lifa"* **Filter,** *green,* Grade No. 201b	
IFROT	**32826**	*"Lifa"* **Filter,** *red,* Grade No. 201c	
IFGEL	**32828**	*"Lifa"* **Filter,** *yellow,* Grade No. 901	
IFSTA	**32842**	**Stand** for *"Lifa"* Filters, mounted to foot, adjustable in height and inclinable	
IFLIF	**32844**	**Stand** with cooling cell for *"Lifa"* Filters, to protect the latter from cracking when subjected to powerful light sources such as arc-lamps, etc.; consisting of a round cell to hold water as cooling medium, the cell mounted to vertical upright on foot, adjustable in height and inclinable; a clamping ring mounted to the cell holder serves the accommodation of filters	
IFLUS	**32846**	**Stand,** for solution filters, mounted to foot, adjustable in height and inclinable, supplied **with solution cell**	
FAHYXOME	**32850**	**Bottle,** with concentrated yellow-green **filter solution,** sufficient for two fillings of cell listed under No. 32846	



ROTARY MECHANICAL STAGE

This stage is recommended for research investigations and photo-micrography and arranged to be adaptable to those microscope stands available for this purpose.

The rotary mechanical stage is offered in two models; i.e.,

Model I, for use in connection with microscopes "AABM" and "AA";

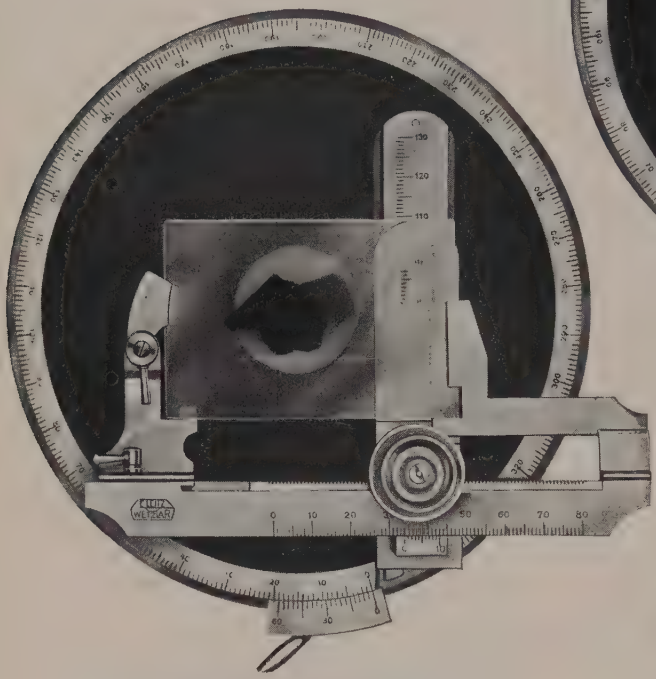
Model II, for use in connection with microscopes "CCBM" and "C."

The stage **Model I** is of 125mm and **Model II** of 112mm diameter. They are provided with centering screws, revolvable and clamping device to arrest the rotation when desired. The mechanical motion is by rack and pinion in two directions, scales divided in millimeters and verniers permitting readings within 1/10mm facilitate reorientation of specimens. Stage **Model I** permits the examination of slides 50 x 75mm from corner to corner while **Model II** covers in its movements a slide 25 x 75mm. Both rotary mechanical stages are designed so that oil does not come in contact with the stage when immersion contact between condenser and slide is established. The mechanical motion device is removable leaving large plain surface with one rack movement for use with large specimens.

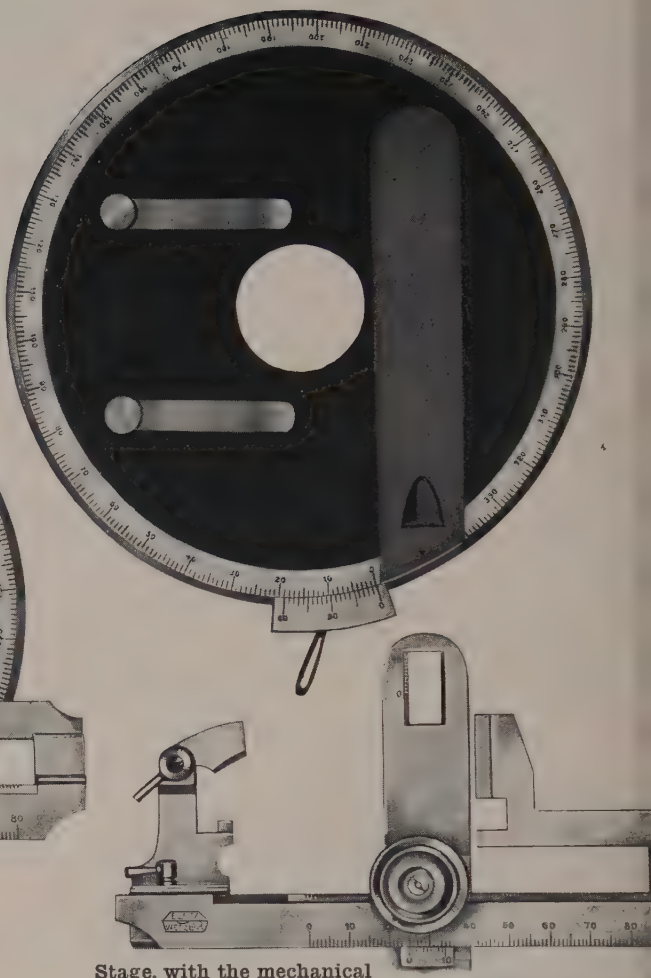
Note: The rotary mechanical stages are interchangeable with plain rotary stages.

Code Word	Cat. No.	Designation	Price
ABDJE	**22611**	**Rotary Mechanical Stage,** *Model I,* as described, diameter 125mm, for slides 50x75mm, for microscopes "AABM" and "AA", **in case**	$
PLAUS	**22611b**	**Rotary Mechanical Stage,** *Model II,* as described, diameter 112mm, for slides 25x75mm, for microscopes "CCBM" and "C", **in case**	
ABMLA	**22623**	**Plain Rotary Stage,** diameter 125mm, for microscopes "AABM" and "AA", for interchangeable use against rotary mechanical stage No. 22611, **without case**	
PYLLZ	**22624**	**Plain Rotary Stage,** diameter 112mm, for microscopes "CCBM" and "C", for interchangeable use against rotary mechanical stage No. 22611b, **without case**	

COMBINATION
ROTARY MECHANICAL STAGE
for Microscope "IURM"



Stage with the mechanical motion device and slide holder attached



Stage, with the mechanical motion device and slide holder detached, rendering stage surface plain; a slider having been inserted close the groove for the mechanical motion device

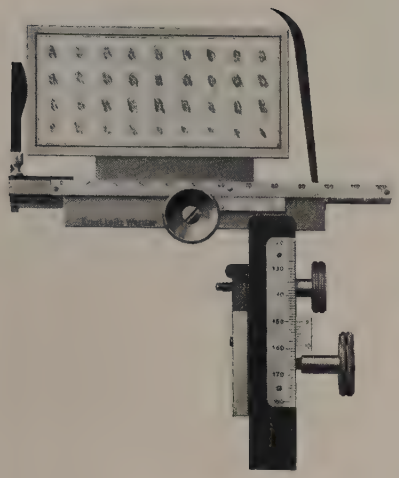
The rotary stage measures 153mm in diameter and is provided with centering screws, situated at an angle of 120° to each other, which impart to the stage a motion within limits of 4.5mm. Its periphery is graduated in 360 divisions and a vernier permits reading to three minutes of the arc. A clamping screw facilitates locking the stage tightly at any desired position.

The mechanical stage proper differs from our standard series of attachable mechanical stages inasmuch as one of the racks for the mechanical motion is embedded in the stage of the microscope. When removing the mechanical motion device for the slide, the groove within the stage is covered by a dove-tailed slider which fits flush with the surface of the stage. Such adaptation of the mechanical stage is a guarantee that it will always adjust itself in a uniform position, assuring that recorded readings are always reliable and that the slide holder fits absolutely snug to the surface of the microscope stage.

The heads acting upon the pinions are situated one above the other, the upper one being of smaller diameter; this feature permits the mechanical motion of the slide, backward and forward or from side to side to be controlled from **one** central position. This stage accommodates slides 50 x 75mm and larger, and carries these entirely free and clear of the microscope stage which is important when oil contact is established between condenser and specimen.

Both mechanical motions are provided with millimeter scales and verniers to permit readings of the slide position within 1/10mm. Considering this feature and furthermore that the microscope stage is graduated at its periphery, affords convenient and at the same time very accurate means to record a point of interest in any object, it being only necessary to record the vernier readings, since thereby the spot of interest can readily be found again.

Code Word	Cat. No.	Designation	Price
PYLKS	22611a	**Combination Rotary Mechanical Stage,** as described, diameter 153mm, for slides 50x75mm, for microscope "IURM", **in case**..... **Note:** *Combination Rotary Mechanical Stage is likewise adaptable to the microscopes "AABM" and "AA."*	$



MECHANICAL STAGE

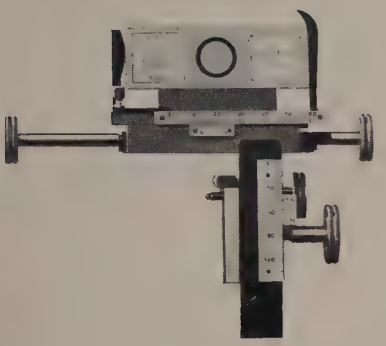
Large Pattern, for Microscopes "ABMS" and "AS"

This stage is of large model, accommodating slides up to the size of 50 x 100mm. Two finely cut rack and pinion movements afford displacement of the specimen in two directions.

The vernier provided for the forward and backward movement permits recording the position of the slide within 1/10mm and the one for the sideward motion within 1/20mm.

Attached to the mechanical stage is a metal wedge with screw, by means of which the stage is securely fastened to the microscope stand, inasmuch as the wedge accommodates itself to the groove provided at the stand.

Code Word	Cat. No.	Designation	Price
DECAZ	**22612**	**Mechanical Stage,** as described, **in case**	$



MECHANICAL STAGE

for Microscopes "CBMS," "C," "D" and "E"

This stage accommodates slides up to the size of 38 x 75mm. The forward and backward movement is controlled by rack and pinion and the sideward motion by worm screw drive.

Verniers are provided for both movements and permit recording the position of the slide within 1/10mm.

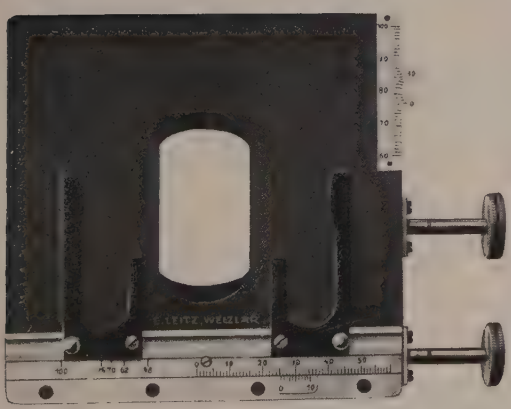
It is fastened to the microscope stand in a similar manner as stage No. 22612.

Code Word	Cat. No.	Designation	Price
DECSV	**22614**	**Mechanical Stage,** as described, **in case**	$

COMBINATION BUILT-IN MECHANICAL STAGE

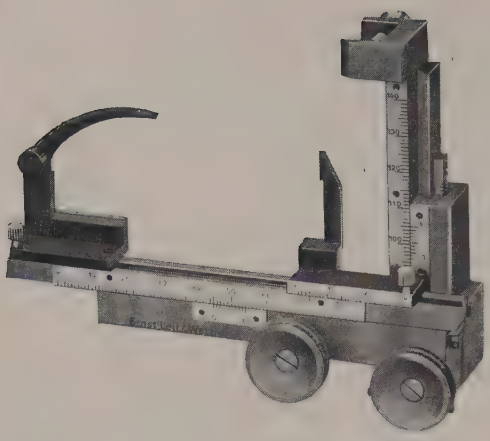
(Two Stages in One)

for Microscopes "ABMT," "CBMT" and "AT"



This stage is of square pattern, combined mechanical and plain, of metal covered with vulcanite. It measures 120 x 120mm. The sideward motion is controlled by worm screw drive, the backward and forward motion by rack and pinion, covering a range of 31 x 51mm respectively. The screw heads are located at the right-hand side and do not obstruct the stage proper. Removing the arms holding the slide converts the stage to a plain surface with complete mechanical motions. Each movement is provided with scales divided in millimeters and verniers facilitate reorientation of specimens.

Code Word	Cat. No.	Designation	Price
PACUDEM	**22613**	**Combination Built-In Mechanical Stage,** as described, 120x 120mm, for microscopes "ABMT", "CBMT" and "AT"	$

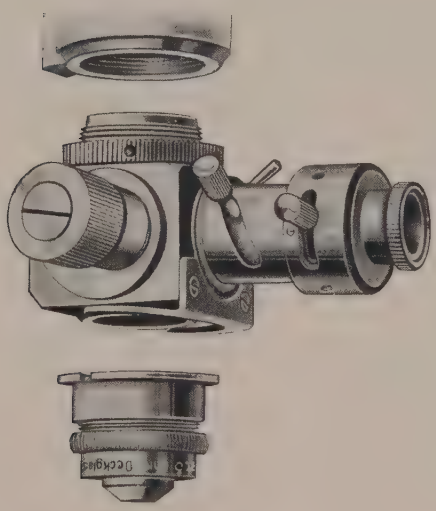


MECHANICAL STAGE

for use with all microscopes having Square Stages

This stage attaches to the side of the microscope stage and is available only for use with microscopes having a stage of square pattern. The movement of the slide is controlled by two racks and pinions and thereby affords a methodical examination of specimens. Two verniers and millimeter scales have been provided to permit a point of interest for reorientation of the slide within an accuracy of 1/10mm. The slide holders are adjustable for the accommodation of slides of varying sizes.

Code Word	Cat. No.	Designation	Price
DECHA	**22622**	**Mechanical Stage,** as described, **with** millimeter scales and verniers, for use with all microscopes having stages of square pattern, **in case**	$
DECCI	**22622a**	**Mechanical Stage,** same as No. 22622, but **without** millimeter scales and verniers, **in case** **Note:** *If mechanical stages are ordered without cases,* ***deduct*** *and* ***add "NOCAS"*** *to code word.*	



LARGE VERTICAL ILLUMINATOR

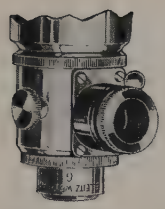
This illuminator has been constructed for the purpose of illuminating objects, such as metal surfaces, etc., for examination with the microscope. This accessory is provided with a society thread by which it attaches to the tube of all standard microscopes. The vertical illuminator is equipped with a simplified objective clutch by means of which the objectives, being provided with adapter collars, are held in place and can easily be interchanged.

A total reflecting prism and a reflecting glass plate are simultaneously mounted to a bar. The bar, fully inserted into the illuminator housing, places the total reflecting prism within the optical rays and when the bar is withdrawn to its extreme stop, the reflecting glass plate is within the optical rays. The use of either depends upon the nature of the specimen and the objective employed. This vertical illuminator is furthermore equipped with a condensing lens and iris diaphragm, by means of which the light rays can be stimulated for proper contrast.

Code Word	Cat. No.	Designation	Price
OPAGE	**22552**	**Vertical Illuminator,** complete as described, with three objective adapter collars, **in case**	$
OPABO	**22550**	**Frame with Reflecting Glass Plate,** attachable to low power objectives (40mm), fitting over the front mounting of the objectives	
OPRIG	**22555**	**Additional Adapter Collar,** for objective	

Note: 1) For the special series of objectives offered for examination of opaque objects, we refer to page 125.

2) For suitable lamps to be used with vertical illuminators, we refer to Nos. 22580 and 22583a (*listed on page 166*).



SIMPLIFIED VERTICAL ILLUMINATOR

In design this illuminator is constructed for convenient illumination of opaque objects for microscopical examination. This model however, is much simpler in type than No. 22552 and consequently does not permit an application in a similar universal manner. It is equipped with a total reflecting prism and iris diaphragm, the latter serving to stimulate the light concentration.

Code Word	Cat. No.	Designation	Price
CERYR	**22556**	**Vertical Illuminator,** simplified model, complete as described, **in case**	$

Note: 1) For the special series of objectives offered for examination of opaque objects, we refer to page 125.
2) For suitable lamps to be used with vertical illuminators, we refer to Nos. 22580 and 22583a (*listed on page 166*).

Examination under Polarized Reflected Light

In order to permit examination of opaque specimens under polarized light, we supply a polarizer which fits into the entrance tube of the vertical illuminators Nos. 22552 and 22556. In conjunction with this polarizer, the analyzer No. 28020 (*listed on page 178*) is likewise required.

Code Word	Cat. No.	Designation	Price
MOPRA	**28028**	**Polarizer,** for attachment to the light entrance tube of the vertical illuminator	$

ULTRA CONDENSER

The ultra condenser, an arrangement for bringing into view microscopically small particles, serves for ultra microscopic observation of gases and liquids, but is not available for the examination of ultra microscopic particles of solids.

The designation "Ultra Condenser" is intended to suggest that the apparatus is an attachment by which an ordinary microscope can be rendered available for ultra microscopic observation.

While in the earlier application of the principle of ultra microscopic observation the illuminating pencil enters the system from one side only, the light transmitted through the ultra condenser is made to converge to a single point from all sides. This is achieved by the arrangement of two spherical reflecting surfaces furnished by two pieces of optical glass. Each ray is subjected to four successive reflections, twice before it encounters the particle and twice after leaving it. In this way the whole of the rays, with the exception of a small fraction, are made to leave the ultra condenser on the side on which the light enters. In the upper piece of glass a spherical chamber is ground out concentric with the point at which the rays intersect. The chamber provides a vessel for gases, vapors or liquids.

Ultra Condenser, attached to Microscope

(*Continued on page 174*)

The optical part of the condenser is permanently fitted within a metal casing. The cover attaches by a bayonet joint and is fitted with a rubber ring which makes an air-tight connection between the cover and the rim of the container. The cover is also provided with two short tubes for the inlet and outlet of liquids or gases. Observation is made through a thin disc of quartz mounted in the center of the cover.

If desired, the ultra condenser can be supplied with a device for producing electric sparks within the substance under examination. In this case the ultra condenser is supplied with an additional cover of ebonite, fitted with terminals and two platinum electrodes, reaching to the center of the chamber.

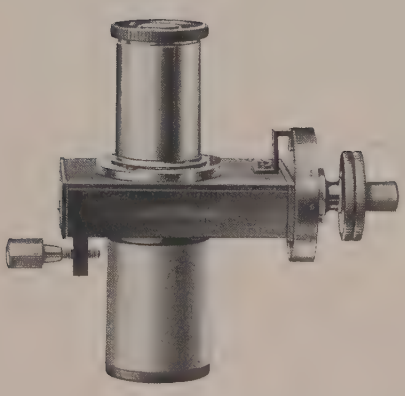
The illustration on page 173 shows a convenient arrangement of a microscope with the ultra condenser attached. The condenser outfit includes a thistle tube as container for the substance to be examined, supplied with a stand, which fits into one of the holes for the stage clips of the microscope. Rubber tubing and a pinchcock are likewise provided with the equipment. The liquid is poured into the thistle tube and by means of the rubber tubing and pinchcock is permitted to pass into and out of the hollow chamber of the condenser.

Code Word	Cat. No.	Designation	Price
CERZO	**22568**	**Ultra Condenser,** as described, with stand, thistle tube, rubber tubing and pinchcock, **in case**	$
CERQT	**22570**	**Ultra Condenser,** same as No. 22568, but with the addition of a **sparking device, in case**	

Note: As illuminants for above ultra condensers, we recommend the arclamps listed on pages 159-161.

MICRO MEASURING DEVICES

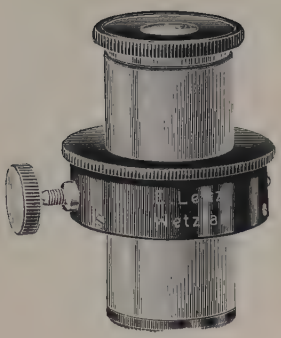
Filar Screw Micrometer Ocular



The filar screw micrometer ocular is intended for the most accurate measurements. A micrometer screw with divided drum is attached to a slider which carries a movable index line. One complete revolution of the drum displaces the index line by 0.5mm and since the drum is divided into 100 intervals it follows that the displacement by one interval is equal to 0.005mm, while 0.001mm can easily be estimated. The ocular is of *"Ramsden"* type of 12.5X. The eyelens being adjustable, it can easily be focused sharply upon the scale. The filar micrometer can be attached to any microscope inasmuch as it fits into the draw tube of same.

Code Word	Cat. No.	Designation	Price
DECDX	**22642**	**Filar Screw Micrometer Ocular,** as described, **in case**	$

Micrometer Oculars



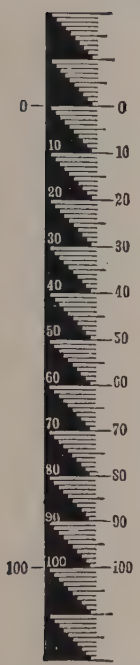
No. 22644

The micrometer oculars are furnished in two forms, one with a movable scale and the other with a fixed scale, both scales measuring 10mm divided in 100 parts. The eye lens of the oculars is adjustable and therefore permits a sharp focus upon the scale.

No. 22646

Code Word	Cat. No.	Designation	Price
DECET	**22644**	**Micrometer Ocular** (*"Huygenian"*), **6X**, with **movable** scale and adjustable eye lens, **in case**	$
DECFO	**22646**	**Micrometer Ocular** (*"Huygenian"*), **6X**, with **fixed** scale and adjustable eye lens, **without case**	
PERMI	**22647**	**Micrometer Ocular** (*"Periplan"*), **6X**, with **fixed** scale and adjustable eye lens, **without case**	

Note: We are prepared to likewise furnish other oculars with micrometer scale if so desired.



Scale of Ocular No. 22648

Step Micrometer Ocular

The scale of this micrometer ocular has the intervals arranged in groups of ten, each group being indicated in an unmistakable manner by a black echelon rising from the first to the tenth interval. This micrometer is one of novel design and possesses the great advantage that the lines can always be seen distinctly whether the object is light or dark. The intervals of the scale are gauged in such a manner as to **give for each objective at a specific tube length, definite micrometer values and thereby an exceedingly easy method of measurement is offered.** (Each step micrometer ocular is supplied with a set of directions and a table of micrometer constants.)

Code Word	Cat. No.	Designation	Price
DECIP	**22648**	**Step Micrometer Ocular,** as described, **without case**	$

Micrometer Discs

These micrometers consist of a glass disc in mounting of a diameter to fit the standard microscope oculars, into which they are inserted by resting upon the diaphragm. If desired, these micrometer discs can likewise be furnished in any specified diameter, in which case an additional charge prevails.

Code Word	Cat. No.	Designation	Price
DECJM	**22650**	**Ocular Micrometer Disc,** 5mm divided in 100 parts	$
DECKU	**22652**	**Ocular Micrometer Disc,** 10mm divided in 100 parts	
DECLN	**22654**	**Ocular Micrometer Disc,** ruled in 0.5mm squares	
DUBIM	**22655**	**Ocular Micrometer Disc,** of step micrometer ocular	

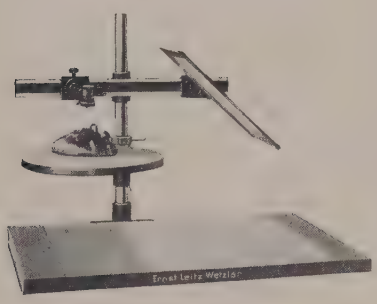
Stage Micrometers

The stage micrometers consist of slides, 25 x 75mm in size, having scales ruled directly upon the slide, provided with coverglass to protect the ruling.

Code Word	Cat. No.	Designation	Price
DECME	**22658**	**Stage Micrometer,** 1mm divided in 100 parts	$
DECNH	**22660**	**Stage Micrometer,** 2mm divided in 200 parts	

Special Micrometer Devices

Code Word	Cat. No.	Designation	Price
OKLAN	33000	**Planimeter Ocular,** adapted for accurate length measurements and the measuring of areas as well as for counting particles, **in case**	$
OKDEN	33005	**Micrometer Ocular after** *Herzog*, especially arranged for measuring the cross sections of fibers by means of a crossline micrometer with lines 0.162mm apart and comprising 400 small squares, 20 in each row; each fifth line is marked a trifle heavier than the others; the eye lens is focusable; **without case**	
OFPLA	33010	**Disc with Crossweb,** ruled on glass, in mounting, to be placed upon the diaphragm of oculars	
ODEPA	33015	**Micrometer Plate after** *Herzog*, identical to the one provided with ocular No. 33005, in mounting, so that it may be placed upon the diaphragm of any available ocular	
OCHEM	33020	**Counting Plate after** *Heim*, ruled with three concentric circles in addition to two crosslines	



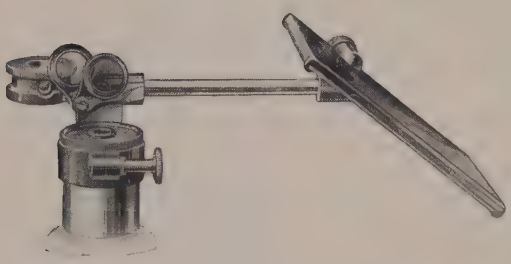
Macroscopic Drawing Apparatus after C. Metz

This instrument has been designed by Dr. C. Metz, member of the research staff of the Leitz Works, and while introduced only a comparatively short time ago, has gained universal favor in College Laboratories for the drawing of objects in natural, magnified or minified size. It has often been indicated to us that the drawing apparatus after *"Metz"* represents the only instrument that fulfills the purpose in an ideal and most satisfactory manner. It permits the drawing of objects in size 250 x 250mm from natural size to a magnification of 15X or a similar minification.

Note: We refrain from giving a detailed description of this apparatus but to those interested, we shall send special pamphlet, No. D-2181, which gives full particulars.

Code Word	Cat. No.	Designation	Price
DEGUN	22665	**Drawing Apparatus after** *Metz*, with base plate 400x600mm, round object stage, support with drawing prism, mirror 160x240mm, all parts replaceable against each other, **including case,** containing three lenses and three smoked glasses in mounting	$

Camera Lucida after "Abbe" Models "A" and "B"



With this apparatus the drawing surface is seen by means of a mirror (fastened to a metal bar by a sliding mounting), and a double prism (cube) imbedded within a metal housing attached to a swinging arm. By means of a clamping ring the complete drawing apparatus is fastened to the draw tube of the microscope and clamped rigidly in place. The swinging arm with prism permits the prism housing to be swung aside to clear the ocular for adjusting the field of view for drawing. When ready to begin with the drawing, the prism is placed over the ocular. The prism mounting is provided with two light moderating glasses in pivoted metal rings, by means of which the light, emanating from the drawing surface, can be stimulated to obtain proper contrast.

Model "A" represents an instrument of medium size, provided with a mirror 60 x 80mm.

Model "B" possesses large dimensions and consequently permits drawings of larger size to be made than is possible with Model "A." The mirror of Model "B" measures 80 x 125mm.

Code Word	Cat. No.	Designation	Price
DECPK	22672	**Camera Lucida after** *Abbe*, **Model "A",** as described, **in case**	$
DECRF	22674	**Camera Lucida after** *Abbe*, **Model "B",** as described, **in case**	

Drawing Ocular

(Microscope being used in vertical position)

This ocular is designed for drawing with the microscope in vertical position. It is inserted into the microscope tube like any other ocular. Its magnification is 6X. By using the drawing ocular, the drawing surface is at once seen clearly and sharply without elaborate adjustments. The rays proceeding from the drawing surface and the pencil point meet the lower and upper faces of the prism at right angles and are totally reflected at the other faces. Secondary images due to reflection by coated mirrors are thus obviated. Any excess of light which may proceed from the drawing surface can be moderated by means of two neutral tint glasses, mounted in metal rings beneath the prism.

Note: If desired any other ocular of the *"Huyghenian"* series except the 12 and 16X can be provided for this drawing ocular.

Code Word	Cat. No.	Designation	Price
DUBAR	**22668**	**Drawing Ocular,** as described, **in case**	$

Drawing Ocular

(Microscope being used in tilted position)

This drawing ocular is similar to No. 22668, however its prism is slightly modified, so that when the microscope is inclined at 45°, the image of the object may be seen on a drawing surface placed immediately behind the microscope stand at the distance of normal vision. When the drawing surface is in proper horizontal position relative to the eye, the image will be seen clearly and without distortion. The light may be moderated by means of two neutral tint glasses in pivoted metal rings.

The advantageous orientation of the drawing surface and the convenience of drawing while the microscope is in an inclined position have gained for this valuable accessory rapid recognition and consequently it is in universal favor amongst College Laboratories.

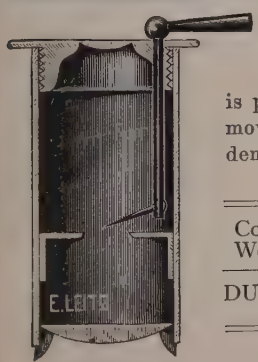
Note: If desired any other ocular of the *"Huyghenian"* series except 12 and 16X can be provided for this drawing ocular.

Code Word	Cat. No.	Designation	Price
DECPJ	**22670**	**Drawing Ocular,** as described, **in case**	$

Object Marker

The object marker is equipped with a diamond point. It serves to mark a spot of interest within an object slide in such a manner to easily find it at any future occasion. In turning the knurled ring, it draws a circle, which can be varied in size as may be desired, by increasing the distance of the diamond point from its center by means of the screw provided.

Code Word	Cat. No.	Designation	Price
DECUG	**22690**	**Object Marker,** as described	$



Demonstration Ocular—Simple Model

This ocular serves the purpose of pointing out special features in the field. It is provided with a pointer which may be moved by a small external lever. By this movement, in conjunction with rotating the ocular within the microscope tube, the demonstrator is enabled to direct attention to any point of interest within the field.

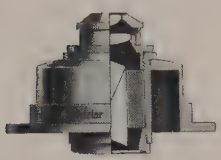
Code Word	Cat. No.	Designation	Price
DUBEP	**22692**	**Demonstration Ocular,** as described	$

Double Demonstration Ocular

The double demonstration ocular has a magnification of 6X and can be inserted into the draw tube of any microscope. It is so arranged that **two observers** can view the same object and still be at a convenient distance apart. The teacher in using the vertical ocular and manipulating the pointer, provided, can indicate to the student any desired portion of the object slide, the student looking through the horizontal ocular. The horizontal tube is equipped with a separate focusing device to permit an adjustment if the eyes of the observers differ.

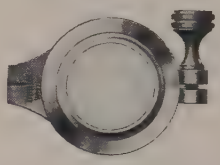
Code Word	Cat. No.	Designation	Price
DECTW	22696	**Double Demonstration Ocular,** 6X, **in case**	$

Micro Polarizing Apparatus



No. 28018

No. 28020



Collar for No. 28020

This apparatus consists of:

A) Polarizer—Provided with *"Nicol"* prism, mounted in spring sleeve by means of which it inserts into the substage frame of the microscope; the polarizer is equipped with a simple condensing system, so as to be likewise available for use with high power objectives.

B) Analyzer—Equipped with a *"Glan-Thomson"* prism, mounted to permit rotation; a clamping screw socket with index fits over the ocular to the microscope tube, and the analyzer rests on this socket upon which it is rotatable. The mounting of the analyzer is equipped with a graduated collar (every tenth line being numbered) to permit reading the degree of rotation. The mounting being provided with a slot, allows the use of compensators.

Code Word	Cat. No.	Designation	Price
MOLOR	**28018**	**Polarizer,** with demountable condenser, for insertion into the spring sleeve of the substage frame	$
MOANA	**28020**	**Analyzer,** with supporting clamping collar, for attaching to the microscope tube	
PYNIT	**28023**	**Selenite Plate,** red, 1st order, for insertion into the slit of the analyzer	
PABADJEX	**28023a**	**Mica Plate,** $\frac{1}{4}\gamma$, for insertion into the slit of the analyzer	
POLSZ	**28023b**	**Quartz Wedge,** 1.-4. order, for insertion into the slit of the analyzer	
POLTH	**28023c**	**Quartz-Selenite Compensator "Johannsen,"** in which the quartz wedge surmounts a selenite plate of such a thickness that at the edge of the wedge the resulting phase-difference becomes zero; the same mount contains, separated from the wedge by vacant aperture, a selenite plate producing red of the 1st order; for insertion into the slit of the analyzer	
DECWB	**22708**	**Selenite and Mica Films,** for attaching to the polarizer, **set of eight**	

No. 22712

No. 22714

No. 520

Turntable No. 22712 serves the purpose to ring coverglasses upon slides and is provided with two stage clips to hold the slides conveniently in place.

Coverglass Micrometer Gauge No. 22714 is especially constructed for convenient measurement of the thickness of coverglasses and slides. Each interval of the drum equals 0.01mm.

The "Elei" Cedarwood Oil Bottle No. 520 is provided with a ground cap and bone dropper. Its size is most handy and on account of its large foot it is not easily tipped over. Due to its convenient form and size it is in universal favor.

Code Word	Cat. No.	Designation	Price
DECZL	**22712**	**Turntable,** as described	$
DIMES	**22714**	**Coverglass Micrometer Gauge,** as described	
DEDGY	**520**	**"Elei" Cedarwood Oil Bottle,** as described	

Electric Heating Stage

This heating stage is attachable to the microscope stage and serves solely for the **qualitative** observation or demonstration respectively without definite and accurate temperature measurement devices. The maximum available temperature the stage renders is approximately 250° C.

Code Word	Cat. No.	Designation	Price
ELTIS	**33050**	**Electric Heating Stage,** as described, complete, **in case**	$
ELWID	**33055**	**Rheostat, 110**-volt, for stage No. 33050	
ELDER	**33060**	**Rheostat, 220**-volt, for stage No. 33050	
ELCAP	**33065**	**Protection Cap,** for objectives for use with heating stages so as to protect the objective lenses against damage by heat	

Automatically Regulated Electric Heating Stage after Walton

This automatically regulating electrically heated stage consists of a flat aluminum casing, which contains a heating spiral surrounding the condenser. The regulating thermometer with its annular bulb is placed next to this spiral. At the middle the aluminum casing has a cylindrical neck with slit openings, through which the object slides may be introduced and held in position by two clips. In this arrangement the object slide is immediately above the condenser and, since the top of the casing is perforated at the middle, the object slide is exposed to the heated air within, while the projecting neck keeps off cooled air.

The reading thermometer is immediately above the object slide. The thermometer is graduated either into tenths of a degree to read from 35 to 50° C. or into whole degrees for higher temperatures up to 100° C. The regulating thermometer has a sliding sleeve which has a contact wire attached to its inner side. Contact with the mercury column may be established at any desired point with the aid of this slide.

Before starting the apparatus care should be taken to note that the mercury of the regulating thermometer is in the outer bend of the tube. It is an easy matter to direct it there, preferably with the lid portion taken off. In making the connections the large plug is to attach to the supply circuit (110- or 220-volt) and the two longer pin contacts with spring slits should be inserted into the heating stage, and finally the two shorter ones to the resistance. On one side the resistance is provided with contacts for 110-volt and on the other for 220-volt. The connections should be made, as shown on the diagram of connections, according to the maximum temperature being 50° or 90° C.

When the current is switched on the heating stage slowly warms up and both mercury columns rise. Now, it should be noted that contact in the regulating thermometer should occur a few degrees below the required constant temperature since the reading thermometer continues to rise through after-heating. In the first half-hour the temperature fluctuates to some extent. This is unavoidable, but after a time it becomes steady and varies at most to the extent of 0.3 to 0.5°. Each heating stage is furnished with a temperature curve. The further regulation of the desired temperature is done in a simple and convenient manner by raising or lowering the contact-pin.

In general it should be noted that the resistance is to be kept at some distance from the heating stage when in use owing to its radiation of heat. Also, it is important that the room temperature should be fairly even and draught should be avoided. During frequent use it is advisable to free the mercury from time to time from the slag which forms on it. **The heating stage can be used in its horizontal position only.**

Code Word	Cat. No.	Designation	Price
ERUHT	**33070**	**Automatically Regulating Electric Heating Stage** *after Walton*, as described, permitting a precise regulation of the temperature within constant periods up to 50 or 100° C., respectively, **in case**	$
REBUT	**33075**	**Rheostat, 110**- to **220**-volt, for Stage No. 33070	

Micro Coverglasses

No. 4010

No. 4015

Coverglasses play an important role in the optical correction of objectives and for this reason we pay particular attention to supplying coverglasses of superior quality and this in respect to uniformness in thickness and color, trueness of size and smoothness of edges.

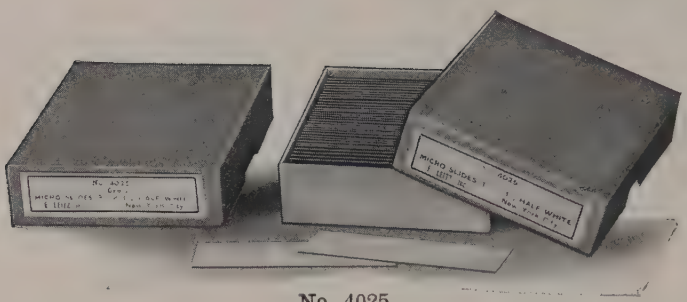
The coverglasses we supply are made from glass especially produced for this purpose and are guaranteed to be non-corrosive. They embody a most important feature viz., they are true to the stated thickness. The square and circular coverglasses are supplied in thickness Nos. 0, 1 and 2 and the rectangular coverglasses in thickness Nos. 1 and 2. If rectangular coverglasses in thickness No. 0 are desired, they can be furnished on special order.

The thickness designations in millimeters are as follows:

No. 0 (less than 0.12mm thick)
No. 1 (about 0.13-0.17mm thick)
No. 2 (about 0.18-0.25mm thick)

Code Word	Cat. No.	Size	Thickness	Price per oz. (Packed ½ oz. in box)
		Circular Coverglasses		$
MACAW	**4010-A**	18mm diam.	No. 0	
MACBQ	**4010-B**	18mm diam.	No. 1	
MACCT	**4010-C**	18mm diam.	No. 2	
MACDL	**4010-D**	22mm diam.	No. 0	
MACEZ	**4010-E**	22mm diam.	No. 1	
MACFO	**4010-F**	22mm diam.	No. 2	
		Square Coverglasses		
MACHI	**4015-A**	18 x 18mm	No. 0	
MACIM	**4015-B**	18 x 18mm	No. 1	
MACJC	**4015-C**	18 x 18mm	No. 2	
MACKR	**4015-D**	22 x 22mm	No. 0	
MACLS	**4015-E**	22 x 22mm	No. 1	
MACMB	**4015-F**	22 x 22mm	No. 2	
		Rectangular Coverglasses		
MACNY	**4020-A**	22 x 35mm	No. 1	
MACOP	**4020-B**	22 x 35mm	No. 2	
MACPE	**4020-C**	22 x 40mm	No. 1	
MACQH	**4020-D**	22 x 40mm	No. 2	
MACRU	**4020-E**	22 x 45mm	No. 1	
MACSN	**4020-F**	22 x 45mm	No. 2	
MACTX	**4020-G**	24 x 32mm	No. 1	
MACUF	**4020-H**	24 x 32mm	No. 2	
MACVA	**4020-I**	24 x 50mm	No. 1	
MACWJ	**4020-K**	24 x 50mm	No. 2	
MACXD	**4020-L**	35 x 50mm	No. 1	
MACYK	**4020-M**	35 x 50mm	No. 2	
MACZG	**4020-N**	35 x 60mm	No. 1	
MCOAQ	**4020-O**	35 x 60mm	No. 2	
MCOBA	**4020-P**	45 x 50mm	No. 1	
MCOCK	**4020-Q**	45 x 50mm	No. 2	
MCODR	**4020-R**	45 x 72mm	No. 1	
MCOEG	**4020-S**	45 x 72mm	No. 2	

Micro Object Slides



No. 4025

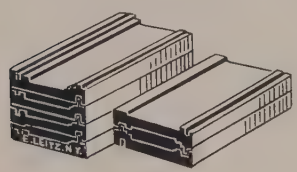
Our selection of micro object slides is now confined to only those made of **half-white glass** for the reason that the formulae of pure white glass is necessarily of such composition that pure white microscopical slides cannot be offered as non-corrosive. Experience has shown that white slides will corrode within a comparatively short time. In view of this fact and since pure white slides are not absolutely essential in microscopical investigation, we have discontinued supplying them from stock and shall henceforth furnish only microscopical slides of "half-white" glass, i.e., made of glass which has a slight greenish tint when viewed edgewise. **The slides of this glass composition are guaranteed by us against corrosion.** Leitz micro object slides are supplied in substantial pasteboard boxes containing one-half gross. **The slides are of selected quality and have thoroughly ground edges.**

Code Word	Cat. No.	Size		Price Per Gross (Packed ½ Gross in Box)
MCOFE	**4025-A**	26 x 76mm (1x3″)	half-white	$
MCOGU	**4025-B***	26 x 76mm (1x3″)	half-white	
MCOJX	**4036-A**	38 x 76mm (1½x3″)	half-white	
MCOKX	**4037-A**	50 x 76mm (2x3″)	half-white	
MCOLX	**4038-A**	25 x 45mm (1x1¾″)	half-white	

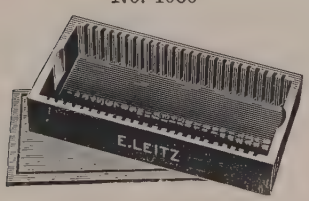
** Micro object slides No. 4025-B represent slides that have been individually selected as to thickness for darkfield work.*

Note: Requests for quotations are solicited for micro object slides for student use, for which absolute perfection is not essential. We are prepared to offer most attractive prices.

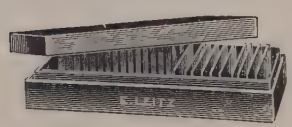
Slide Boxes



No. 4060



No. 4065



No. 4070

No. 4060 **Microscopical Slide Boxes** (Mailing Cases).
Code Word: MCOMF.....**Per doz. pieces $**

No. 4065 **Microscopical Slide Box,** of white wood, with cover fitting inside, to hold 25 slides 26 x 76mm (1 x 3″), numbered and indexed.
Code Word: MCOND .....**Per doz. $**

No. 4066 **Microscopical Slide Box,** same as No. 4065, but to hold 25 slides 50 x 76mm (2 x 3″).
Code Word: MCOOS.....**Per doz. $**

No. 4070 **Microscopical Slide Box,** of white wood, with cover overlapping, to hold 25 slides 26 x 76mm (1 x 3″), numbered and indexed.
Code Word: MCOPY.....**Per doz. $**

No. 4072 **Microscopical Slide Box,** same as No. 4070, but to hold 25 slides 50 x 76mm (2 x 3″).
Code Word: MANYV.....**Per doz. $**

No. 4075 **Microscopical Slide Box,** with wooden racks, pasteboard covered, grooved to hold 100 slides 26x76mm (1x3″), in two rows, with hinged cover and two catches, with index.
Code Word: MCOQV.....$

No. 4075

No. 4076 **Microscopical Slide Box,** same as No. 4075, but for 100 slides 38 x 76mm (1½ x 3″).
Code Word: MCORB.....$

No. 4080 **Microscopical Slide Box,** same as No. 4075, but for 100 slides 50 x 75mm (2 x 3″).
Code Word: MCOST.....$

No. 4082 **Microscopical Slide Box,** same as No. 4075, but for 100 slides 25 x 45mm (1 x 1¾″).
Code Word: MANZW.....$

HAEMACYTOMETER

with Leitz Counting Chamber
of new one-piece construction

Complete Haemacytometer in Aluminum Case

The Leitz counting chambers are manufactured with utmost precision and are guaranteed to conform in every respect to the specifications established by the U. S. Bureau of Standards. If desired, the counting chambers, pipettes, or complete haemacytometers will be supplied with U. S. B. of S. certificate at extra charge. The mixing pipettes which we furnish are likewise of the same accuracy and are guaranteed in a similar manner as the counting chambers.

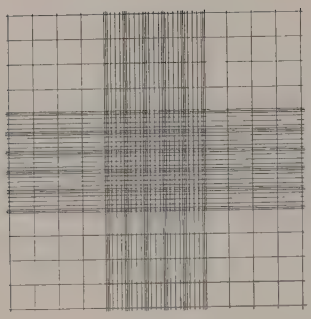
As a matter of safeguard, laboratories should select only those haemacytometers, pipettes, etc., offered by firms of unquestionable reputation. ***Minute precision is of incalculable importance in the manufacture of blood counting apparatus since even a very slight error in the depth of the counting chamber, the spacing of its rulings, or the graduations of the pipettes will grossly impair the final result of the blood count and render the diagnosis doubtful.*** **The Leitz Works, with their far-reaching experience in the manufacture of precision instruments, are known to produce blood counting apparatus to meet the most exacting requirements.**

The Leitz counting chambers are furnished in *one-piece construction* in consequence of which they can be easily cleaned and this precludes any danger of parts becoming separated through cleaning reagents—a permanent safeguard for accuracy.

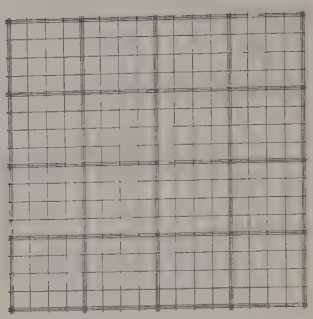
The Leitz blood counting chambers of single as well as double type are all furnished with the **improved *"Neubauer"* ruling.** This ruling provides in the center section, for the counting of red blood corpuscles: 25 groups of 16 squares each, each group of 16 squares being surrounded by a triple boundary line, the middle line of which acts as the border line of the outer squares of the group. The four corner groups of 16 larger squares serve for the counting of white corpuscles.

To comply with the ever-increasing demand to render the haemacytometer case of sanitary construction, we have designed an aluminum case to hold the counting chamber, two pipettes and extra coverglasses. This case measures 145 x 73 x 16mm.

(Our complete haemacytometers or counting chambers, respectively, are accompanied by a booklet giving complete directions.)

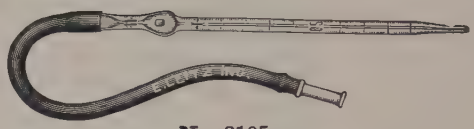


Improved *"Neubauer"* ruling



"Fuchs-Rosenthal" ruling

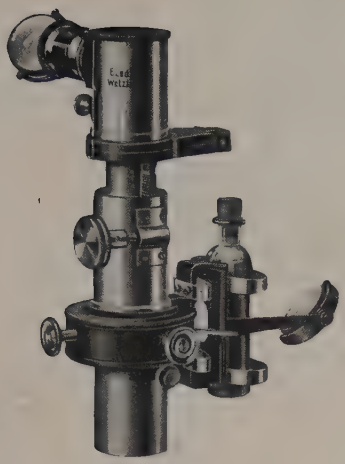
No. 3100
"Thoma" Pipette for RED corpuscles



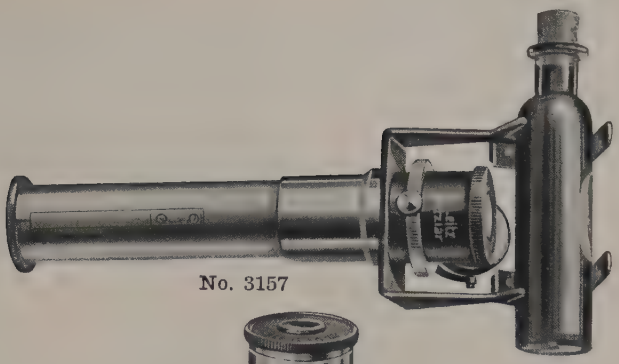
No. 3105
"Thoma" Pipette for WHITE corpuscles

Nos. 3120 and 3125
Precision Pipette *"Pappenheim"*

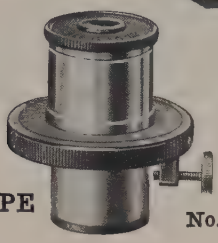
Code Word	Cat. No.	Designation	Price
		COUNTING CHAMBERS	
EBLAW	**3020**	*"Elei"* **Counting Chamber, One-Piece Type,** with **Single** *"Neubauer" Improved* ruling, with two plano coverglasses, in pasteboard box.....	$
EBLBU	**3035**	**Same as No. 3020,** but with **Double** *"Neubauer" Improved* ruling.....	
EBLCX	**3080**	**Same as No. 3020,** but with **Single** *"Fuchs-Rosenthal"* ruling.....	
EIBDO	**3090**	**Same as No. 3020,** but with *"Helber"* Cell.....	
		HAEMACYTOMETERS	
EBLTC	**3056**	**Haemacytometer,** complete, with *"Elei"* counting chamber, one-piece type, with **Single** *"Neubauer" Improved* ruling, one pipette for red and one for white corpuscles; two plano coverglasses, in compact **aluminum case,** measuring 145x73x16mm	
EBLVL	**3071**	**Haemacytometer,** complete, with *"Elei"* counting chamber, one-piece type, with **Double** *"Neubauer" Improved* ruling, one pipette for red and one for white corpuscles, two plano coverglasses, in compact **aluminum case,** measuring 145x73x16mm	
		ACCESSORIES	
EBLJS	**3100**	**Blood Diluting Pipette,** *"Thoma,"* for **red** corpuscles, diluting 1 to 100 and 1 to 200, with rubber tubing and mouthpiece.....	
EBLLV	**3105**	**Blood Diluting Pipette,** *"Thoma,"* for **white** corpuscles, diluting 1 to 10 and 1 to 20, with rubber tubing and mouthpiece.....	
EBLNG	**3120**	**Blood Diluting Pipette, Precision Model,** *"Pappenheim,"* with all-glass syringe attachment, for **red** corpuscles, diluting 1 to 100 and 1 to 200; this pipette is specially recommended in contagious cases to prevent infection; the syringe attachment furthermore allows the blood or diluting fluid to be exactly drawn up to the mark desired.....	
EBLOM	**3125**	**Same as No. 3120,** but for **white** corpuscles, diluting 1 to 10 and 1 to 20	
EBLPH	**3135**	**Coverglass,** 20x26mm, 0.4mm thick, with optically plano surfaces.....	
EBLRK	**3136**	**Coverglass, Reinforced** with heavy glass ring, thickness of coverglass 0.18mm.....	
EBLSE	**3140**	**Case,** of leather, velvet lined, for *"Elei"* counting chamber with single or double ruling.....	
EIBGA	**3145a**	**Case,** of **Aluminum,** measuring 145x73x16mm., for complete haemacytometer, with single or double ruled counting chamber.....	



No. 3158



No. 3157



No. 3155

MICRO SPECTROSCOPE
No. 3158

The Micro Spectroscope fits like an ordinary ocular into the microscope tube, and has a clamping screw, by means of which it may be secured in any desired position. It is primarily designed for the observation of absorption spectrae of microscopic objects as well as solutions. The ocular is of exceptionally low power and has its eyelens so mounted that it may be sharply focused upon the slit by means of a rack and pinion. The width and length of the slit can be varied symmetrically by using two screws placed at right angles to each other.

A comparison prism is mounted below the slit and by means of a lever it may be shifted in and out of axis. Two clamps are fitted to the side of the tube of the spectroscope for the accommodation of small vials filled with comparison fluid. Absorption plates may be attached to the side in a similar manner. The upper part of the spectroscope contains a triple *"Amici"* prism which furnishes approximately direct vision with respect to the "F" line of the spectrum.

To facilitate the adjustment of the object, the tubular mount of the *"Amici"* prism is attached to a joint and may be swung aside. The axial position of the prism is insured by a spring catch. The upper mirror serves to superimpose upon the spectrum a wave-length scale, graduated in terms of *"Angstroem"* units. The scale is contained in a revolving mount and may be displaced with respect to the position of the spectrum so as to render it possible to set the scale parallel to the spectrum and to eliminate parallax. In addition, the spectrum may be adjusted by a screw situated below the scale tube, viz., the "D" line may be set to correspond to 58.9 on the scale.

When adjusting the scale, the illumination should not be too glaring, otherwise the spectrum may be flooded with light and the lines rendered indistinguishable.

HAND or POCKET SPECTROSCOPES
Nos. 3156-3157

These spectroscopes are designed for quick and reliable observations of different kinds of spectrae and are suitable for physicists, signal engineers and laboratory technicians, when it is not required to make definite measurements.

The slit is constructed in a most careful manner and accurately adjustable. Dispersion is accomplished by a series of three prisms. An achromatic lens is situated between the dispersing prisms and the slit. The slit is brought into focus by the axial displacement of the lens.

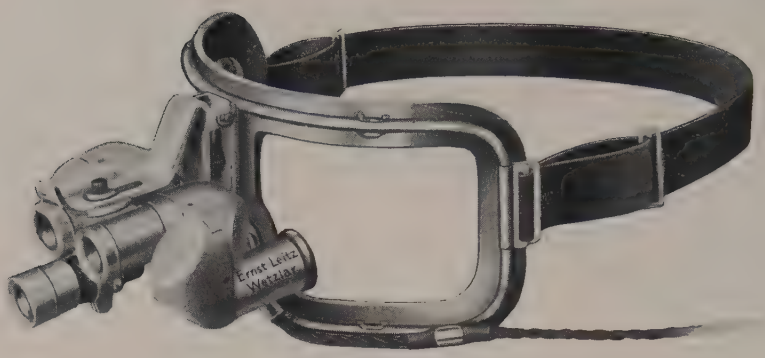
Both spectroscopes Nos. 3156 and 3157 are identical **except that No. 3157 is provided with a comparison prism, rendering a standard spectrum, and clamp for holding specimen vials, containing the fluid under examination.**

COUNTING OCULAR *"EHRLICH"*
No. 3155

The *"Ehrlich"* ocular has been devised for determining the numerical ratio between the red and white corpuscles in **stained, dry mounted** preparations. This accessory consists of a *"Huyghenian"* ocular 6X fitted with a square stop which can be varied in size by means of an external knob. One of the sides of the square stop is divided into four equal parts and notched at the respective points, and hence, when the stop is completely opened and successively set at ¾, ½ and ¼ of the side, the resulting square fields are in the ratios of 16:9:4:1. The large squares should be used to count the more numerous species.

Code Word	Cat. No.	Designation	Price
EIBNX	**3158**	**Micro Spectroscope,** as described, **in case**	$
EIBOG	**3157**	**Hand or Pocket Spectroscope,** as described, **with** comparison prism and clamp for holding specimen vials, **in case**	
EIBPY	**3156**	**Hand or Pocket Spectroscope,** as described, **without** comparison prism or clamp for holding specimen vials, **in case**	
EIBRV	**3155**	**Counting Ocular** "Ehrlich," as described, **in case**	

BINOCULAR MAGNIFIER



No. 36000

Magnification: 3.5X *Free Working Distance: 300mm*

The new binocular magnifier offers full advantage of **stereoscopic vision** inasmuch as the very same underlying principles applied to binocular field glasses have been used.

Some of the chief advantages are:

1. Improved general definition;
2. Objects appear in their natural form, viz., 3 dimensions;
3. Freedom from eye-strain;
4. Long working distance;
5. Large field of view;
6. Comparatively high magnification;
7. Adjustment for individual pupillary distance.

In the same manner as a binocular field glass, the head magnifier is adjusted for interpupillary distance and consequently in its construction is adaptable to the eyes of any user. The images are formed in a practically parallel manner, making it possible to examine deep cavities with both eyes simultaneously. The magnifier is so arranged that it can be swung upward to free the eyes for direct observation. The lamp is mounted in front to the head band so as to still illuminate the object even in case of the magnifier having been swung aside. The frame of the head band is so arranged that the observer can make use of his customary eye-glasses.

The Leitz new head magnifier, aside from being particularly suited for the examination of coarse objects such as anatomical, botanical, zoological, embryological, and entomological specimens, etc., is with great satisfaction applicable for examination in throat, nose and ear work.

The magnifier is attached to a frame made of thin soft copper tubing resting upon a rubber lining. The observer may bend the frame to accommodate it to the shape of his forehead so as to rest conveniently against the head without strain or discomfort. The magnifier is mounted adjustably both as to head and eyes. Arranging it for a narrow interpupillary distance, the magnifier is to be made to rest somewhat higher than in the case when it is to be adjusted for a wide interpupillary distance. Once adjusted to meet the individual interpupillary distance of the observer, it is then rigidly clamped to retain its position. For this purpose a pin is supplied to be inserted into the screw head, provided with appropriate holes to accommodate it.

Illumination: The lamp of the illuminator consists of a bulb 8-volt, 0.6 ampere. The lamp bulb is one of special construction and gives a maximum amount of light at an entirely even and flat illumination.

The illuminant is properly adjusted by shifting a lens cap and the beam of light is centered by using one eye in looking through the magnifier while the other observes the object independently of the magnifier. The lens cap which is mounted in front of the lamp likewise serves to tightly clamp the lamp in place after it has once been correctly adjusted and to accomplish this, it is only required to turn the lens cap to the right-hand side. If the lamp housing becomes somewhat too hot to manipulate the lens cap by hand, one will have to utilize the insulation handle by means of which to clamp the lamp tightly in place.

With the magnifier is supplied an extra lamp with lens cap to serve as replacement in case of accident. To effect the replacement, one has to simply loosen the screw at the holder, unscrew the one lamp with mounting and screw the new one in place. The centering of the illuminating rays will then again have to be attended to in the same manner as previously suggested.

Code Word	Cat. No.	Designation	Price
LEDFM	**36000**	**Leitz New Binocular Head Magnifier, 3.5X,** free working distance 300mm, with head band, extra lamp, complete as described, **in case**..	$
		Inasmuch as it is necessary to utilize in connection with the lamp of the magnifier, a rheostat or transformer, dependent upon the current conditions, we recommend selection from the following:	
RACAQ	**32970**	**Rheostat,** 110-volt, D. C.	
RACVZ	**32972**	**Rheostat,** 220-volt, D. C.	
RACCH	**32974**	**Transformer,** 110-volt, A. C.	
RACDS	**32976**	**Transformer,** 220-volt, A. C.	
REKEY	**32978**	**Adjustable Rheostat,** combination model, for 110 and 220 volt with ammeter, available for D. C. and A. C.	
RACEV	**36005**	**Lamp Bulb,** 8-volt, 0.6 ampere, with lens cap (for replacement)	
		In case of it being preferred to use the magnifier independently of house current, we supply:	
RACFM	**36010**	**Battery,** 8-volt, 0.6 ampere	

DISSECTING MICROSCOPE

Model W

Lens Arm—Heavy construction, provided with joint so that the entire field of the stage may be covered; maximum distance from center of pillar to center of magnifier 80mm.

Focusing Adjustment—By rack and pinion with milled head on either side, giving a range of 80mm.

Stage Glass—80 x 95mm, removable; second set of grooves beneath stage accommodate a metal plate with circular disc to provide white or black background; spring clips attached to stage support.

Hand Rests—Of metal, 90mm in length and detachable, leather covered.

Base and Pillar—Base of metal, modified horseshoe form; round pillar, of metal, attached to base.

Mirror—Plano 50mm diameter, one side of opal glass; mounted on swinging arm.

Lens—"Doublet" or triple "Aplanat" are regularly supplied; lens arm will hold any of our regular magnifiers for dissecting microscopes (*see page 191*).

Finish—Base in black alcohol-proof lacquer, pillar in blond lacquer.

Case—Of wood, highly polished and fitted with lock and key.

Code Word	Cat. No.	Equipped with Magnifiers		Price
		Magnification	Formulae	
CONAP	**W-1**	10X	Doublet	$
CONBN	**W-2**	6 and 10X	Doublet	
CONEG	**W-3**	6, 8 and 10X	Doublet	
CONGR	**W-4**	10X	Triple Aplanat	
CONHV	**W-5**	10 and 20X	Triple Aplanat	
CONIK	**W-6**	8, 16 and 20X	Triple Aplanat	
CONJX	**W**	**Dissecting Microscope,** complete in case, **without** magnifiers		

Note: If different magnifiers than those listed in connection with the above dissecting microscope are desired, select from page 191 and add to stand listed under "W."
If the dissecting microscope is wanted **without case, deduct** $.

DISSECTING MICROSCOPE

Model X

Lens Arm—Heavy construction, provided with rotatable joint.

Focusing Adjustment—By rack and pinion with milled head on either side, giving a range of 60mm.

Stage—Metal, with large circular opening in which is fitted a glass disc; spring clips attached to stage support.

Hand Rests—Of metal, 90mm in length and detachable, leather covered. (**Are furnished only if especially ordered.**)

Base and Pillar—Base of metal, modified horseshoe form; round pillar of metal, attached to base.

Mirror—Plano 40mm diameter, one side of opal glass; mounted in adjustable frame.

Lens—"Doublet" or triple "Aplanat" are regularly supplied; lens arm will hold any of our regular magnifiers for dissecting microscopes (*see page 191*).

Finish—Base in black alcohol-proof lacquer, pillar in blond lacquer.

Case—Of wood, highly polished and fitted with catch.

Code Word	Cat. No.	Equipped with Magnifiers		Price
		Magnification	Formulae	
CONKB	X-1	10X	Doublet	$
CONLD	X-2	6 and 10X	Doublet	
CONME	X-3	6, 8 and 10X	Doublet	
CONOF	X-4	10X	Triple Aplanat	
CONPH	X-5	10 and 20X	Triple Aplanat	
CONSJ	X-6	8, 16 and 20X	Triple Aplanat	
CONTM	X	**Dissecting Microscope,** complete in case, **without** magnifiers		
CONUT	X-7	**Metal Hand Rests,** leather covered		**per pair**

Note: If different magnifiers than those listed in connection with the above dissecting microscope are desired, select from page 191 and add to stand listed under "X."
If the dissecting microscope is wanted **witout case, deduct** $.

No. 214

DISSECTING STAGE

This dissecting stage consists of a cast iron foot supplied with an opal glass plate. Upon a vertical rod slides an adjustable lens holder permitting a convenient manner of focusing the magnifier.

Code Word	Cat. No.	Equipped with Magnifiers		Price
		Magnification	Formulae	
CALBU	214-1	10X	Doublet	$
CIFXB	214-2	6 and 10X	Doublet	
CIFYM	214-3	10X	Triple Aplanat	
CIFZL	214-4	8 and 20X	Triple Aplanat	
CALAG	214	**Dissecting Stage, without** magnifiers		

No. 218 No. 219 No. 220

STANDS for DISSECTING MAGNIFIERS

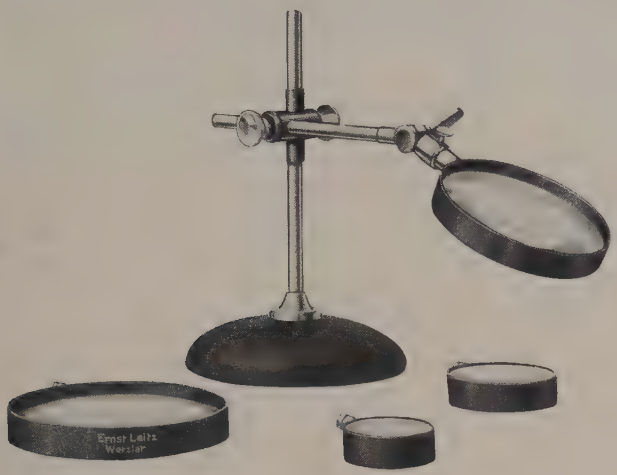
Stand No. 218 is supplied with rack and pinion movement for focusing the magnifier. Due to the heavy iron foot it maintains a rigid position. The lens arm is provided with two inclination joints, while the magnifier arm is turnable in its socket and telescopes within a tube, by means of a screw, to be rigidly clamped into position.

Stand No. 219 consists of a heavy cast iron foot, mounted thereto a vertical pillar and this is equipped with a clamp into which slides the horizontal rod with lens holder. The clamp, being provided with a screw, permits the horizontal rod with lens holder to be oriented in any convenient position relative to the object. The lens holder is equipped with a ball socket joint and thereby affords the magnifier a universal movement.

Stand No. 220 consists of a heavy cast iron foot with vertical pillar and attached thereto is the lens arm, being provided with two inclination joints for convenient orientation of magnifier relative to object.

Code Word	Cat. No.	Equipped with Magnifiers		Price
		Magnification	Formulae	
CYLHV	218-1	10X	Doublet	$
CYLKA	218-2	6 and 10X	Doublet	
CYLLX	218-3	10X	Triple Aplanat	
CYLMI	218-4	8 and 20X	Triple Aplanat	
CALFX	218	**Stand for Dissecting Magnifiers,** as described, **without** magnifiers		
CYLNR	219-1	10X	Doublet	
CYLOW	219-2	6 and 10X	Doublet	
CYLPD	219-3	10X	Triple Aplanat	
CYLRU	219-4	8 and 20X	Triple Aplanat	
CALGY	219	**Stand for Dissecting Magnifiers,** as described, **without** magnifiers		

CYLSM	**220-1**	10X	Doublet
CYLTI	**220-2**	6 and 10X	Doublet
CYLUG	**220-3**	10X	Triple Aplanat
CYLVP	**220-4**	8 and 20X	Triple Aplanat
CALHV	**220**	**Stand for Dissecting Magnifiers,** as described, **without** magnifiers	



Lens Stand No. 220a consists of a heavy cast iron foot, mounted thereto a vertical pillar and this equipped with a clamp into which slides the horizontal rod. To the latter is fastened a clamp permitting the magnifier to be held in any desired position. The clamp carries a socket into which the magnifiers Nos. 224f-224k (*listed on page 193*) can be inserted and used interchangeably.

Code Word	Cat. No.	Designation	Price
NABILCAP	**220a**	**Lens Stand,** as described, without magnifiers	$

Note: The Magnifiers Nos. 224f-224k (*listed on page 193*) are recommended for use with this stand.

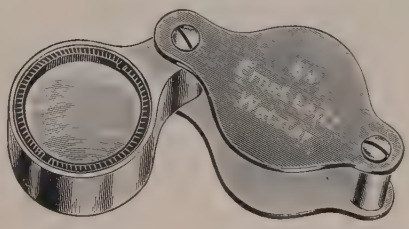
DOUBLET MAGNIFIERS

Mounting A

for Dissecting Microscopes, Lens Stands and Holders

Mounting B

as Hand Lens in Pocket Form



The Doublet Magnifiers consist of two plano-convex lenses and are available in two different mountings, viz., **A** and **B**, as illustrated. These magnifiers give very satisfactory results for use whenever a good lens at a reasonable cost is desired.

Code Word	Cat. No.	Diameter of Lenses	Field of View diameter	Magnification	Mounting	Price
CALMP	**222a**	15mm	15mm	10X	**A**	$
CALNS	**222b**	20mm	20mm	8X	**A**	
CALOB	**222c**	20mm	20mm	6X	**A**	
CALPH	**222d**	20mm	35mm	4X	**A**	
CALQL	**222AA**	15mm	15mm	10X	**B**	
CALRC	**222BB**	20mm	20mm	8X	**B**	

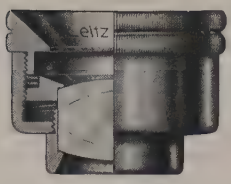
Note: Lenses Nos. 222AA and 222BB are furnished without containers.

TRIPLE APLANATIC MAGNIFIERS

"Steinheil" Lenses

Mounting A

for Dissecting Microscopes, Lens Stands and Holders



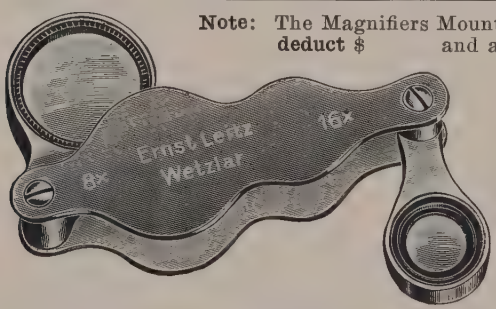
Mounting B

as Hand Lens in Pocket Form

Triple Aplanatic Magnifiers are equipped with two meniscus lenses of flint glass and these are separated by a double convex lens of crown glass. The field being large, it is endowed with a perfect correction for chromatic aberration, as well as for flatness, astigmatism and distortion. The triple Aplanatic Magnifiers are constructed according to well-known *"Steinheil"* formulae and are recommended for the highest class of work. These magnifiers are available in two different mountings, viz., **A** and **B** as illustrated.

Code Word	Cat. No.	Diameter of Lenses	Free Working Distance	Field of View	Magnification	Mounting	Price
CALSE	**225a**	22mm	32mm	30mm	**6X**	**A**	$
COBAC	**232a**	22mm	32mm	30mm	**6X**	**B**	
CALTM	**225**	17mm	25mm	22mm	**8X**	**A**	
COBBA	**232**	17mm	25mm	22mm	**8X**	**B**	
CALUT	**226**	13mm	20mm	15mm	**10X**	**A**	
COBCX	**233**	13mm	20mm	15mm	**10X**	**B**	
CALVN	**227**	11mm	17mm	11mm	**12X**	**A**	
COBDY	**234**	11mm	17mm	11mm	**12X**	**B**	
CALWZ	**228**	8mm	12mm	7mm	**16X**	**A**	
COBEZ	**235**	8mm	12mm	7mm	**16X**	**B**	
CALXR	**229**	6mm	10mm	5mm	**20X**	**A**	
COBFS	**236**	6mm	10mm	5mm	**20X**	**B**	
CALYW	**230**	4mm	6mm	3.5mm	**30X**	**A**	
COBGO	**237**	4mm	6mm	3.5mm	**30X**	**B**	
CALZK	**231**	3mm	5mm	2mm	**40X**	**A**	
COBHR	**238**	3mm	5mm	2mm	**40X**	**B**	

Note: The Magnifiers Mounting B include a leather case. If desired without case, **deduct** $ and add "NOCAS" to code word.

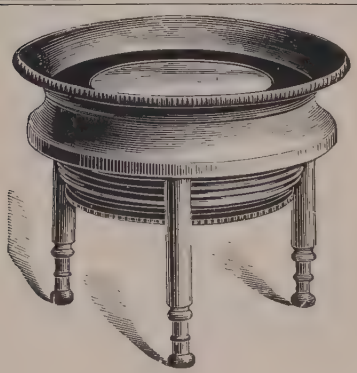


TRIPLE APLANATIC MAGNIFIERS

"Steinheil" Lenses

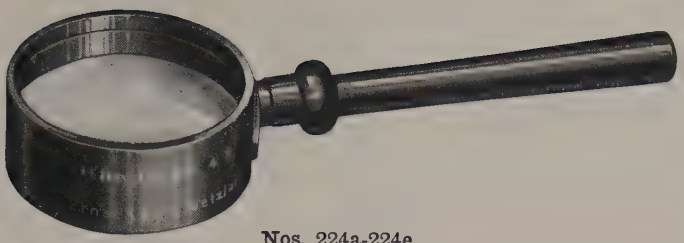
TWO Magnifiers in ONE Mounting

Code Word	Cat. No.	Diameter of Lenses	Free Working Distance	Field of View	Magnification	Price
COBIL	**239b**	17 and 8mm	25 and 12mm	22 and 7 mm	**8 and 16X**	$
COBJU	**239c**	13 and 6mm	20 and 10mm	15 and 5 mm	**10 and 20X**	
COBKJ	**239d**	8 and 4mm	12 and 6mm	7 and 3.5mm	**16 and 30X**	



Note: The Magnifiers Mounting B include a leather case. If desired without case, **deduct** $ and add "NOCAS" to code word.

Code Word	Cat. No.	Description	Price
COBSF	**220B**	**Tripod Dissecting Magnifier,** giving a large and clear field, with magnification sufficient for elementary purposes; the lens mount being provided with a thread for focusing.....	$



Nos. 224a-224e

Code Word	Cat. No.	Designation	Price
NAHIV	**224a**	**Hand Magnifier 4X,** composite system consisting of relatively thin flat lenses of **50mm** diameter mounted in brass frame, dull black lacquered, with black polished wooden handle; due to its large field and absence of distortion, this magnifier is recommended as a hand lens of comparatively high magnification	$
NAHKY	**224b**	**Hand Magnifier—Reading Glass—2¼X,** consisting of one bi-convex lens of **86mm** diameter, mounted in brass frame, dull black lacquered, with black polished wooden handle	
NAFACENU	**224c**	**Hand Magnifier—Reading Glass—2X,** same as No. 224b, lens of **100mm** diameter	
NAHNE	**224d**	**Hand Magnifier 2½X,** composite system consisting of two plano-convex lenses of **54mm** diameter, mounted in brass frame, dull black lacquered, with black polished wooden handle	
NAHOL	**224e**	**Hand Magnifier 4½X,** same as No. 224d, with lenses **39mm** diam.	
NABOLEJA	**224f**	**Hand Magnifier,** same as No. 224a, **without handle,** however in mounting for use with lens stand No. 220a (page 191)	
NABULFEN	**224g**	**Hand Magnifier,** same as No. 224b, **without handle,** however in mounting for use with lens stand No. 220a (page 191)	
NABYLIKO	**224h**	**Hand Magnifier,** same as No. 224c, **without handle,** however in mounting for use with lens stand No. 220a (page 191)	
NACALFIN	**224i**	**Hand Magnifier,** same as No. 224d, **without handle,** however in mounting for use with lens stand No. 220a (page 191)	
NACELSUS	**224k**	**Hand Magnifier,** same as No. 224e, **without handle,** however in mounting for use with lens stand No. 220a (page 191)	
NACILTER	**224-1**	**Handle,** suitable for attaching to the magnifiers Nos. 224f-224k; by means of this handle, the magnifiers originally ordered for use with lens stand No. 220a can likewise be utilized as hand magnifiers	

SIMPLE POCKET MICROSCOPES

Nos. 241 and 241a

No. 242

The Pocket Microscope No. 241 has a magnification of 40X. It is provided with a slot for the insertion of object slides, the clamping device holding the slides rigidly in place. The top lens is so arranged that it remains in focus upon the slide after the latter has been inserted.

The Pocket Microscope No. 241a has a varying magnification of 40, 80 and 120X. The variation in the magnifying power is obtained through the interchangeable use of different top lenses, otherwise this microscope is identical to No. 241. No. 241a is used very extensively in field work.

The Pocket Microscope No. 242 is endowed with a magnification of 100X. Due to its application it is frequently termed "Algoscope," since it is particularly serviceable for the examination of Algae and Infusoriae. The inner tube, having on its top a glass plate for the accommodation of the specimen, is focusable to obtain a sharp image.

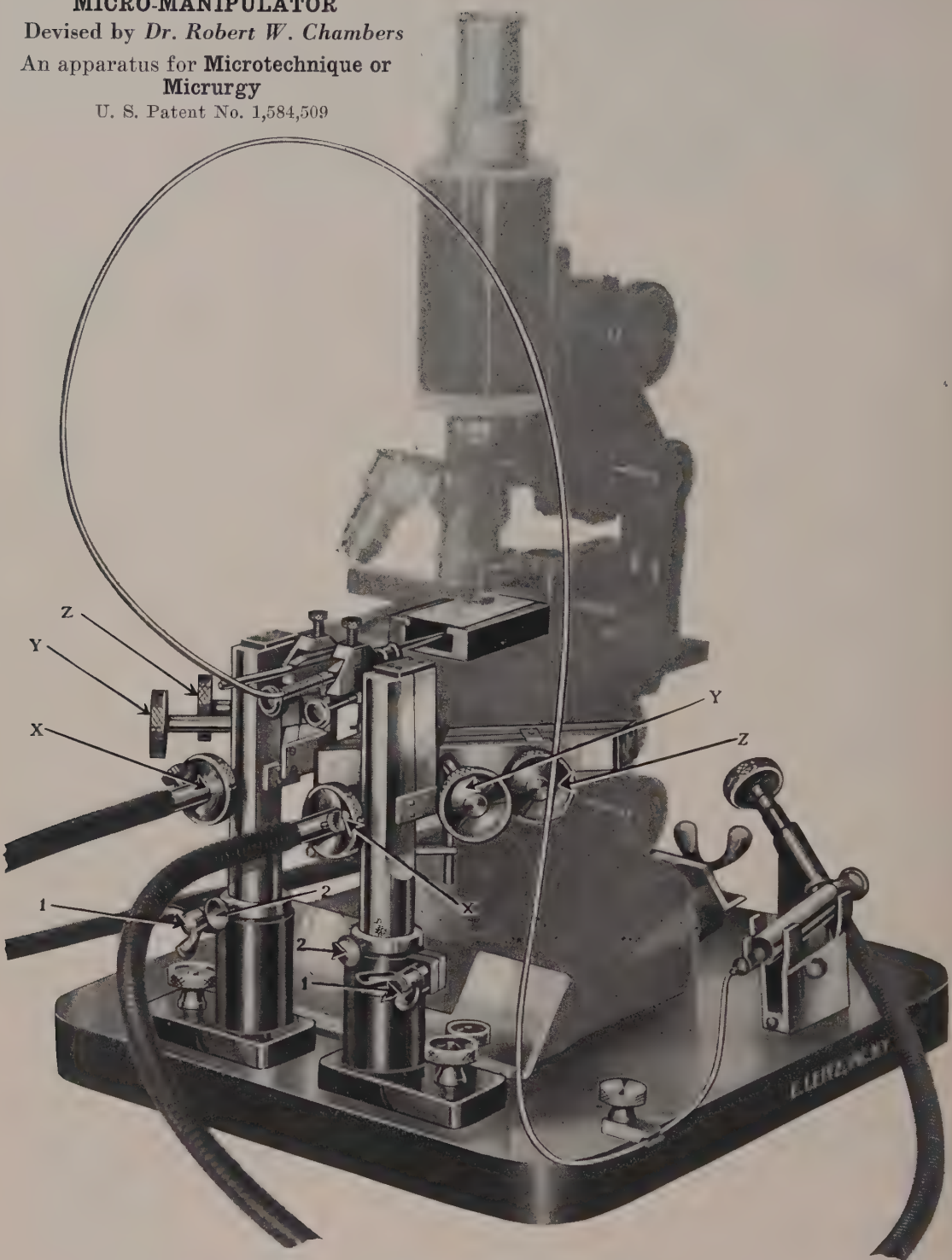
Code Word	Cat. No.	Description	Price
COBLV	**241**	**Pocket Microscope,** as described, complete **in case,** with two object slides	$
COBMI	**241a**	**Pocket Microscope,** as described, complete **in case,** with two object slides	
COBNT	**242**	**Pocket Microscope "Algoscope,"** as described, complete **in case**	

MICRO-MANIPULATOR

Devised by *Dr. Robert W. Chambers*

An apparatus for **Microtechnique or Micrurgy**

U. S. Patent No. 1,584,509



Model 1: Consisting of Two Manipulators

Designation of numbered parts:

1—Clamping screws to hold pillars firmly in place;

2—Clamping screws to arrest pillars at proper height;

X—Knurled heads for micrometer movement of needles in perpendicular axis;

Y— } *Knurled heads for micrometer movement*
Z— } *of needles in horizontal axis.*

(*Continued on page 195*)

MICRO-MANIPULATOR (Continued)

Purpose:

This apparatus manipulates micro needles and micro pipettes in the field of the microscopic image. **The accuracy of the movements** which this instrument imparts to the needles and pipettes **enables one to operate under the highest magnifications.** The fields of scientific endeavor to which the microtechnique with this apparatus has already been adapted are as follows:

Bacteriology—for the isolation of bacteria and yeast cells in the cultivation of pure strains;

Experimental Embryology—for operating on the egg in problems of fertilization, for operating on *Blastomeres,* for injecting substances into the *Blastocoele,* etc.;

Experimental Protozoology—for micro operations on various *Protozoa;*

Cellular and Histological Anatomy—for ascertaining the physical nature of the various constituents of the cell and of the tissue elements;

Cell Physiology—for studying the hydrogen-ion concentration within the living cell, the effect of tearing the cell membrane in various solutions, the effect of injecting solutions into the interior of the cell or of withdrawing material from the cell.

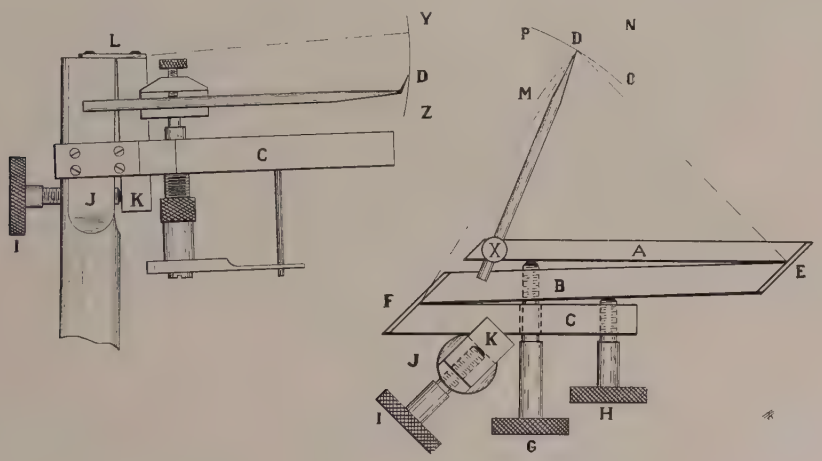
The extraordinary delicacy of the operative work made possible by means of the micro manipulator can be imagined when one considers that the tips of the micro needles are fine enough to impale and dissect a red blood cell which is only 0.008 of a millimeter or 0.000315 of an inch in diameter.

Working Principle:

The principle of this device is demonstrated on considering the mechanism for the movements in one plane only (sketch below, which represents a reproduction of the illustration of article *"New Apparatus and Methods for the Dissection and Injection of Living Cells,"* by Robert Chambers, from *The Anatomical Record, Vol. 24, No. 1, August 1922*).

The mechanism consists of three bars of rigid metal connected at their ends by resilient metal acting as a spring-hinge. By the action of micrometer screws, the bars can be forced apart; on reversing the screws, the bars return to their original position owing to the spring action at the end of the bars. By these means, arc movements may be imparted to the tip of a needle when placed in the proper position.

The needle, or any other suitable device, the tip of which is to be manipulated, is held in a carrier fastened to the free end of a bar "A" at "X." The needle is made to extend so that its tip is at the apex of an imaginary triangle at "D." In order to obtain two movements at right angles to one another and in the horizontal plane, the tip of the needle must be at the apex "D" of a right-angled triangle the base of which is a straight line joining the centers "E" and "F" of the two springs holding the three bars "A," "B" and "C" together. The shank of screw "G" passes through a large hole in bar "C" and is screw-threaded in bar "B." Turning it spreads apart bars "A" and "B" and imparts an arc movement to the needle tip at "D" at right angles to that procured by turning screw "H."



Above diagram shows the working principle of the Micro-Manipulator. In "a," where the instrument is viewed from the side, screw "I" moves needle tip through vertical arc "y-z." In "b," where the instrument is viewed from above, screws "G" and "H" move the needle tip through the horizontal arcs "m-n" and "o-p."

The movement in the vertical plane at right angles to the aforementioned movements is produced by screw "I" and abuts against a vertical extension "K" of bar "C." The extension "K" is parallel to the bar "J" and is connected to it at its top by means of a solid spring-hinge. Turning screw "I" spreads apart bars "J" and "K" and lifts the whole combination "A," "B" and "C" and imparts an arc movement in the vertical plane to the tip of the needle at "D."

(*Continued on page 196*)

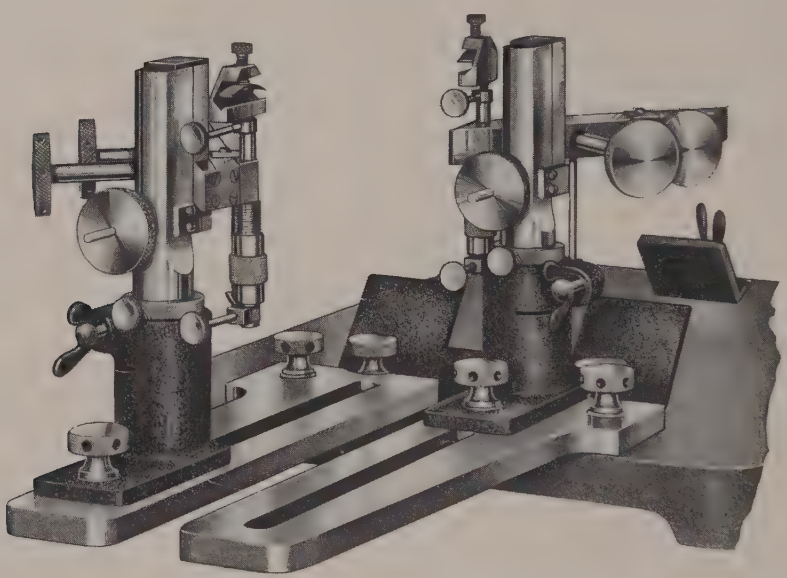
MICRO-MANIPULATOR—(Continued)

The Need of One or Two Manipulators:

The necessity of having one or two manipulators depends upon the type of work to be done. **For picking up bacteria, one is sufficient. For micro dissection in experimental embryology a great deal can be done with one manipulator, but for cell injection in general and for tissue cell dissection two are indispensable so that two needles or a needle and a pipette may be manipulated simultaneously.** When two devices are to be used, both are placed at the front of the microscope so that the needles may extend, side by side, into the moist chamber from the front. The horizontal bars of each device extend diagonally under the microscope stage. According to their position with respect to the microscope, these two models have been designated as "left-handed" and "right-handed." For bacteriological work, where it is more convenient to work from the left, the "right-handed" model is to be preferred as it can be placed to the left of the microscope so that the pipette may extend into the moist chamber from the left.

The microscope should be used with mechanical stage for moving the moist chamber. Since the cell or tissue to be dissected lies in a drop hanging from the roof of the chamber, the motion imparted by the mechanical stage moves the cell against the micro needle. Indeed, most of the dissection, where a single needle is used, is done by first bringing the needle tip into the cell and then dragging the cell away by moving the mechanical stage.

Extension Arms for the MICRO-MANIPULATOR as Aid in the Isolation of Single Bacterial Cells



These extension arms have been devised by William H. Wright, Ph.D., and are described in an article *"An Accessory to the Chambers Apparatus for the Isolation of Single Bacterial Cells"* by William H. Wright, Ph.D., and Elizabeth F. McCoy, M.S., from the Department of Agricultural Bacteriology, University of Wisconsin.—*The Journal of Laboratory and Clinical Medicine, Vol. XII, No. 8, p. 795, May, 1927.*

In bacteriological work it is necessary to remove the bacterial cell from the moist chamber after it is picked from a droplet. With the micro-manipulator in its original form, the mechanical arms being mounted on stationary supports, the pipette with the single cell is required to be removed by hand. The narrow opening in the moist chamber as well as the compact nature of the manipulator present certain difficulties which frequently resulted in the breaking of the delicate tip of the pipette or in contamination of the culture.

(Continued on page 197)

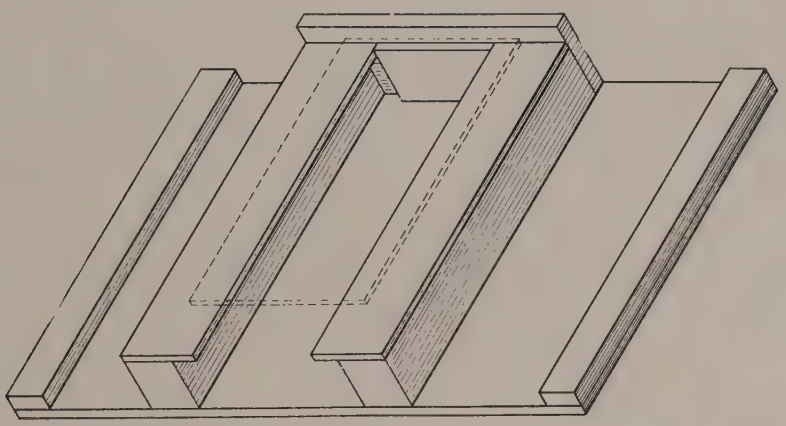
MICRO-MANIPULATOR—(Continued)

In order to avoid this, Dr. William H. Wright suggested the construction of extension arms by means of which the mechanical manipulator with pipette attached could be removed in a straight line and in the same horizontal plane away from the moist chamber. As the illustration (*page 196*) implies, the sockets of the manipulator glide within a slot of the extension arms and they are ground to the sliding track with minute precision so that a movement of utmost smoothness and ease is evident. When it is desired to remove the pipette from the moist chamber, the screw at the clamping socket is released and the entire manipulator is slid back on the track of the extension arm to clear the pipette of the moist chamber. During the movement, the pipette holds the same lateral and horizontal positions which it retained while in the moist chamber. In this position it is a simple operation to remove the pipette or break off the tip in order to plant the culture.

The extension arms for moving the manipulator away from the moist chamber, render the further advantage of working with one apparatus without having the other one to obstruct the work. This method allows much freer use of the vertical coarse adjustment than when both manipulators must be kept in the working position.

INJECTION APPARATUS for the MICRO-MANIPULATOR

The injection equipment supplied for the micro-manipulator consists of a *"Luer"* syringe, capacity 1 or 2cc, mounted in a device which allows the plunger to be moved with the operator's finger either directly or through the medium of a turn-screw or lever, respectively. A slender coiled brass tube is provided which at one end connects with the syringe and at the other end with a nozzle, the latter being clamped to the needle holder. Several adapters are available into which the slender glass micro pipettes are cemented. The entire injection equipment fastens by means of a holder and clamping device to the base-plate supporting the manipulator.



Moist Chamber

The base of the moist chamber is a thin glass slide about 50 x 75mm in size. The sides consist of strips of plate glass about 50mm long and 6mm wide, and of a height determined by the available condenser, viz., 10mm. One end of the chamber is closed with a strip of glass of the same height as the sides and backed by another strip a fraction higher. The trough of the chamber should be from 18-22mm wide. Wet strips of blotting paper may be placed along the sides of the trough. Frequently it is preferable to have the entire floor of the moist chamber flooded with water. The moist chamber is designed for cover slips of a size of 22 x 40mm. The cover slip is sealed on the chamber with vaseline. Square cover slips may also be used, if the rest of the chamber be roofed with other strips of cover glass.

The moist chamber is open at one end to permit the entrance of the micro needles or pipettes.

For bacteriological purposes a type of moist chamber should be used with its open end directed to the left of the microscope. It should be approximately 12mm high, 18mm wide and 60mm long.

(*Continued on page 198*)

MICRO-MANIPULATOR—(Continued)

Code Word	Cat. No.	Designation	Price
MANAS	28300	**Micro-Manipulator after Dr. Robert W. Chambers—double pattern—for Dissection and Injection** (*not including the injection equipment nor the flexible shafts*), consisting of: microscope base-plate, **two** pillars with universal micrometer movements, two needle holders, two nozzles, four adapters for mounting needles.....**Net**	$
MANBY	28305	**Micro-Manipulator after Dr. Robert W. Chambers—single pattern—for Bacteriological Work** (*not including the injection equipment nor the flexible shaft*), consisting of: microscope base-plate, **one** pillar with universal micrometer movements, one needle holder, one rubber hose, one nozzle, one mouthpiece, two adapters for mounting needles.....**Net**	
MANCA	28310	**Note:** If the **single** apparatus No. 28305 is later on to be converted into one of **double** pattern, the additional pillar with appropriate mechanism can be ordered at.....**Net**	
MANRM	28312	**Extension Arm after Dr. William H. Wright**.....**Net** **Note:** *For the **single** Micro-Manipulator only **one** extension arm is required, while for the micro manipulator **double** pattern, **two** extension arms are necessary.*	
MANDI	28315	**Micro-Injection Apparatus after Dr. Robert W. Chambers,** readily attachable to the microscope base-plate, consisting of: "*Luer*" syringe 2cc mounted in socket for clamping to base-plate, clamping screw for holding metal tube in place, nozzle for pipette adapter, brass tube and six adapters.....**Net**	
MANET	28320	**Flexible Shaft** for distance operation of vertical micrometer movement of needle (as illustrated with the double micro-manipulator on page 194), consisting of: flexible cable, holder, clamp for fastening cable to base-plate.....**Net** **Note:** ***One** shaft is required for the **single** and **two** shafts for the **double** apparatus.*	
MANGU	28330	**Adapter** for attachment of micro needles or micro pipettes to nozzle.....**Net**	
MANSL	28341	**Precision Holder,** representing a screw device lined with rubber into which the needles or pipettes respectively can be clamped securely without it being necessary to cement these individually to adapters.....**Net**	
MANTN	28332	**Substage Condenser,** "*Special Model,*" with long working distance, without iris diaphragm, for use with moist chambers ..... **Note:** *Substage condenser No. 28332 is recommended for use with microscopes having complete substage provided with iris diaphragm on separate bracket.*	
MANUG	28334	**Substage Condenser,** "*Special Model,*" with long working distance, including iris diaphragm, for use with moist chambers..... **Note:** *Substage condenser No. 28334 is recommended for use with microscopes having a simplified substage in connection with which no separate iris diaphragm carrier is provided.* (The above condensers are normally supplied with microscopes of Leitz make and if desired with microscopes of other manufacture, we require the exact dimensions of the condenser sleeve; extra charge for alterations will prevail.)	
MANVC	28336	**Darkfield Condenser,** with long working distance, for use in connection with moist chambers and objectives of low and medium magnification (only objectives up to 10mm focal length and 0.004 numerical aperture are applicable).....	
MANWK	28338	**Darkfield Condenser,** "*Special Model,*" with long working distance and high numerical aperture, for use in connection with moist chambers of special construction (these condensers permit use of objectives of highest magnification including oil immersions).....	
IRTIS	22564a	**Objective Body with Iris Diaphragm,** for use with objectives higher in numerical aperture than 0.85 so that their numerical aperture may be reduced to coincide with the numerical aperture of the darkfield condenser No. 28338 (this funnel stop has to be available when darkfield condenser No. 28338 is to be used)..... **Note:** *Darkfield condenser No. 28338, being of special construction, has been arranged for use in connection with Leitz microscopes of the "A" series only; the stage of the microscope to be provided with an appropriately large opening.*	

(*Continued on page 199*)

MICRO-MANIPULATOR—(Continued)

Code Word	Cat. No.	Designation	Price
MANKR	28345	**Moist Chamber** of 10mm height.....**Net**	$
MANLO	28350	**Moist Chamber** of 13mm height.....**Net**	
MANPE	28355	**Moist Chamber** of 19mm height.....**Net**	
MANXD	28357	**Moist Chamber,** *"Special Model,"* for use with darkfield condenser No. 28338.....**Net**	
		The following two microscope models and their equipments are recommended for use with the micro-manipulator:	
AKEGA	ABMS-12	**Leitz Combination Microscope,** model **"ABMS"** for **binocular** and **monocular** vision, with complete substage "b" including **three-lens** condenser N.A. 1.40 (by removing the front lens this condenser is available for long working distance in connection with moist chambers), with binocular and monocular tubes, square object stage, triple dustproof nosepiece, Achromatic objectives **10x** (16mm) — dry, **30x** (6mm) — dry, Fluorite oil immersion **70x** (2.6mm), paired *Huyghenian* oculars 6X and 10X, in mahogany cabinet with lock and key..... **Note:** *This microscope is illustrated and described on pages 46-47.*	
		OR:	
ABDWB	L-12	**Leitz Laboratory Microscope,** model **"L"** for **monocular** vision only, with simplified substage including **three-lens** condenser N.A. 1.40 and iris diaphragm (by removing the front lens, this condenser is available for long working distance in connection with moist chambers), square object stage, triple dustproof nosepiece, Achromatic objectives **10x** (16mm)—dry, **30x** (6mm)—dry, Fluorite oil immersion **70x** (2.6mm), *Huyghenian* oculars 6X and 10X, in hardwood cabinet with lock and key..... **Note:** *This microscope is illustrated and described on pages 74-75.* (We have listed only two microscope stands of our vast variety of different models; viz., one of research—and the other of standard laboratory type. Either of these two and likewise other models are available for use with the Micro-Manipulator after Dr. Robert W. Chambers. It is recommended, however, to select one of the larger models. The base-plate of the Micro-Manipulator will accommodate any standard type microscope of Leitz or other manufacture.)	
DECHA	22622	**Mechanical Stage,** for use with above microscopes and any other equipped with square stage, complete with scales and verniers, **in case**..... (For additional accessories for use in connection with the Micro-Manipulator, we refer to Pamphlet No. 1086.)	

We offer PAMPHLET No. 1086 in which the Micro-Manipulator after Dr. Robert W. Chambers is found illustrated and described more elaborately than in this catalog.

MICRO ATTACHMENT-CAMERAS

Attachable to Any Standard Microscope

Camera Proper

Camera Attached to Microscope

These attachment-cameras take photographs of microscopical images in an easy and quick manner. With both models listed, either plates or filmpacks can be used. The smaller type *"Macca"* renders pictures 1¾ x 2⅜ in. (45 x 60mm) and the larger camera *"Makam"* renders pictures 3¼ x 4¼ in. (90 x 120mm).

Both models can readily be attached to any standard microscope without resorting to the troublesome interposition of adapters and other means of fastening. The Cameras simply slide into the microscope tube in place of the ocular, and in this manner are securely held in place.

The camera *"Macca"* **weighs 9 ozs. or 10¾ozs. including plate holders and plates, while the camera** *"Makam"* **weighs 13½ ozs. or 18½ ozs. with plate holders and plates.** Due to their compact size and little weight, it is naturally not necessary to resort to special fastening devices for the microscope tube. The draw tube will even retain its normal position without being especially secured.

Both cameras may be used with any ocular and these are readily interchangeable, the adapter ring of the camera being removable. *"Periplan"* oculars render pictures of exceptionally good definition. *"Periplan"* ocular 8X, regularly supplied with the camera, is particularly well adapted, since it completely covers the plate or film, respectively. When oculars of lower power are used, the image is cut down by the ocular-diaphragm, while oculars of higher power furnish only the middle portion of what is seen in the microscope. **Unless otherwise ordered, we supply** *"Periplan"* **ocular 8X with the cameras.**

In general, it will be found advisable to obtain a camera *"Makam"* for plate-size 3¼ x 4¼ in. inasmuch as the unit magnification of this camera **is identical to the magnification as rendered in visual observation.** This camera is furthermore particularly well adapted for illustrations in publications and for making lantern slides. The camera *"Macca"* for plate-size 1¾ x 2⅜ in. is likewise furnished with tele-lens whereby the magnification is equal to **one-half of that obtained in visual observation.** Due to the simple numerical ratio, a comparison with tabulated values is easily made and the smaller model, therefore, affords similar advantages as the larger type except that it does not render pictures of lantern slide size.

The side telescope with which both cameras are equipped, permits constant observation of the object while taking photographs. **In order to have the largest possible volume of light available for instantaneous exposures, the prism which reflects part of the rays towards the observation telescope can, through pressure upon a wire release, be dislodged from the optical rays during the time of exposure thereby eliminating the light absorption incident to the reflecting surfaces of the prism.**

When using the attachment cameras, the ocular of the side telescope is always to be first focused sharply upon the cross-line visible within the ocular. This accomplished, the object is focused through the side telescope by using the rack and pinion coarse adjustment or the micrometer fine adjustment of the microscope, in the identical manner as though the microscope were focused without the attachment camera. If the image has been focused sharply through the side telescope, **the same image is equally sharp at the ground glass screen or plate,** respectively, since the focusing plane at the plate coincides with the focusing plane of the side telescope. The focusing screen serves solely the purpose of judging the volume of light prevailing and consequently the time of exposure required for each individual photograph, since the coarse grain of the ground screen does not very well permit a focus or observation of the minute details of a micro image particularly under high magnifications.

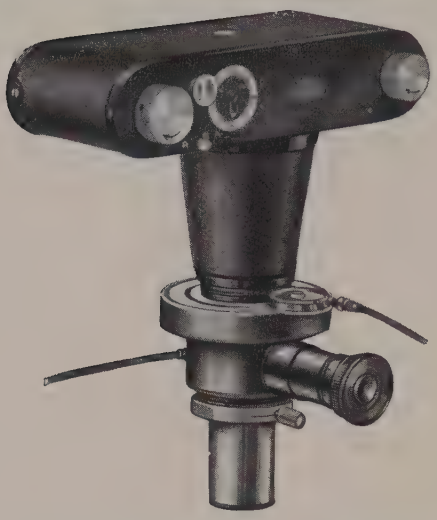
The cameras are supplied with a shutter which is available for time and instantaneous exposures. The plate holder or filmpack adapter slides easily into the appointed frame and is securely held in place by two snap springs. Pressing upon two small levers releases them instantly for withdrawal from the frame. *One should observe not to kink the wires of the release attachments which otherwise hinders their proper function.*

Code Word	Cat. No.	Designation	Price
MICCA	**22719**	**Photo-Micrographic Camera "Macca",** complete with *"Periplan"* Ocular 8X, two plate holders for plates 1¾x2⅜ in., one ground screen, two wire release attachments, **in case**	$
MICCE	**22721**	**Same as No. 22719,** but supplied **with filmpack adapter,** for films 1¾x2⅜ in. in place of plate holders, otherwise complete	
MICCI	**22723**	**Plate Holder,** 1¾x2⅜ in. extra	
MICCO	**22726**	**Filmpack Adapter,** 1¾x2⅜ in. extra	
MICCU	**22727**	**Plates,** 1¾x2⅜ in. } We supply these items at standard prevailing prices.	
MICCY	**22728**	**Filmpacks,** 12 films to a pack, 1¾x2⅜ in. }	
MIKAM	**22730**	**Photo-Micrographic Camera "Makam",** complete with *"Periplan"* Ocular 8X, two plate holders for plates 3¼x4¼ in., one ground screen, two wire release attachments, **in case**	
MIKBE	**22732**	**Same as No. 22730,** but supplied **with filmpack adapter,** for films 3¼x4¼ in. in place of plate holders, otherwise complete	
MIKDI	**22734**	**Plate Holder,** 3¼x4¼ in. extra	
MIKFA	**22736**	**Filmpack Adapter,** 3¼x4¼ in. extra	
MIKGU	**22737**	**Plates,** 3¼x4¼ in. } We supply these items at standard prevailing prices.	
MIKJE	**22738**	**Filmpacks,** 12 films to a pack, 3¼x4¼ in. }	
GANOWONI	**22740**	**Automatic Release Attachment** by means of which both wire releases (included with the above cameras) can be utilized as one unit	

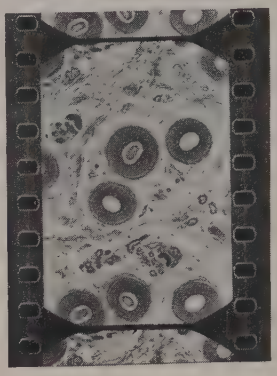
ROLL FILM MICRO ATTACHMENT CAMERA

Attachable to Any Standard Microscope

THIS CAMERA USES STANDARD CINEMA FILM



This Camera attaches to the Microscope in the very same manner as the Cameras "Macca" and "Makam," pages 200-201.



Specimen of image produced with Roll Film Micro Attachment Camera. The characteristics under which this photograph was taken are as follows:

1. Standard type microscope;
2. Achromatic objective 16mm;
3. *"Periplan"* ocular 8X;
4. Magnification 27X;
5. Low voltage lamp as illuminant;
6. "Lifa" filter No. 200b;
7. Exposure: 1/10 second;
8. Condenser diaphragm closed one-half;
9. Film used: Leitz special cinema film.

Heretofore, the demonstration of microscopical specimens through projection was solely confined to the use of lantern slides. Aside from lantern slides being costly to produce, they are easily broken and represent a bulky collection while transporting them from one lecture room to another. This obstacle is quickly recognized amongst scientists who have to do with lecture work and the reason for an ever-increasing use of film slides (film rolls) for projection is therefore readily conceived. So far, no camera has been available for taking pictures of microscopical specimens upon film slides, and **with the introduction of the Leitz Roll Film Micro Attachment Camera, a long felt demand has been complied with.**

Construction: The camera consists principally of a metal housing resembling the one of the well known *"Leica"* camera (described on pages 280-282), and furthermore contains the same film transmitting mechanism the *"Leica"* camera provides. Within the chamber, the film is carried by magazines made of brass and cylindrical in shape. Each chamber contains a spool to hold standard perforated cinema film in lengths of approximately 5¼ ft. This length suffices for 36 pictures each measuring 36 x 24mm (double cinema frame size). The magazines, however, can be loaded with any strips of shorter lengths. The exceptionally fine grain of the cinema film and the favorable size of the picture produced by the camera, render the negatives available for extensive enlargements.

The magazines are loaded in daylight with film supplied by us in daylight packing. The loaded film magazines are in all cases inserted into the camera chamber in daylight. A counter tally disc is provided at one side of the camera housing and this disc registers automatically the number of exposures made. The lower end of the camera is provided with a conical adapter and situated within the latter is found a lens combination to **render the magnification at the film one-third in value of the magnification obtained with the microscope.** Attached to the conical adapter are the very same side telescope and shutter provided with the attachment cameras *"Macca"* and *"Makam"* (described on pages 200-201). The side telescope permits constant observation of the object while taking photographs. In order to render the largest possible volume of light for instantaneous exposures, the prism which reflects part of the rays towards the observation telescope can, through pressure upon a wire release, be dislodged from the optical rays during the time of exposure and thereby eliminates the light absorption incident to the reflecting surfaces of the prism. As ocular best adapted for photographs with this camera, we recommend the *"Periplan"* ocular 8X. (This ocular is included in the standard equipment listed below.) In respect to focusing with the camera, we refer to the instructions outlined in connection with the models *"Macca"* and *"Makam"* on pages 200-201.

The negative film slides prepared through the use of the Roll Film Micro Attachment Camera can readily be copied upon positive film for projection. For this purpose, we offer the contact printer *"Eldia"* No. 35550 (listed on page 203 and described in detail on page 281). For projecting the positive film slides we recommend the film slide projector *"Uleja"* No. 25600 (listed on page 203 and described in detail on page 257).

Note: Adopting the method of preparing lecture material by means of the Roll Film Micro Attachment Camera will bring with it the following advantages which should not be under-estimated:

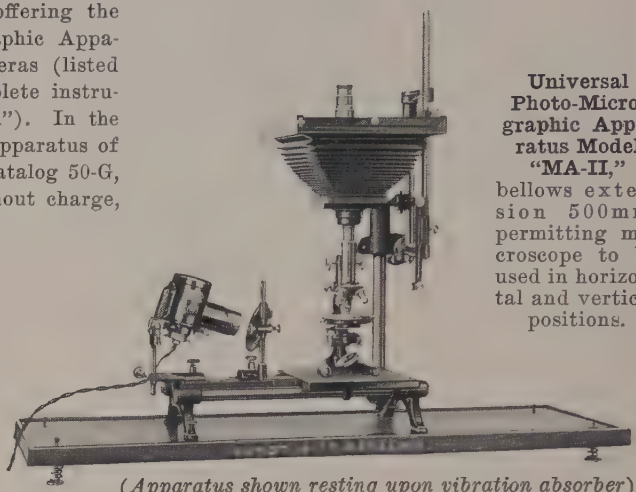
1. ***Enough film for a complete lecture can be carried in the vest pocket,*** while previously an equivalent quantity of lantern slides was a cumbersome task to transport, not to speak of the heavy expense incident to the preparation of the lantern slides.
2. Projecting the film rolls by means of the film projector *"Uleja"* ***renders available an apparatus of light weight easily carried in a satchel of small size.***

ROLL FILM MICRO ATTACHMENT CAMERA

Code Word	Cat. No.	Designation	Price
MIFILMCA	**27700**	**Roll Film Micro Attachment Camera** for standard cinema film, picture size 24x36mm (1⅜x1 in.), with one film magazine, side telescope, instantaneous shutter, two wire releases, "*Periplan*" ocular 8X, **in case**	$
GANOWONI	**22740**	**Automatic Release Attachment** by means of which both wire releases (included in No. 27700) can be utilized as one unit	
FILMO	**35100**	**3 Strips Cinema Negative Film** "*Agfa*" (**non-orthochromatic,** sensibility—16/17° SCH.) each 5¼ ft. long (for 3x36=108 exposures), **standard packing,** in one light-proof tin **per tin**	
FILLI	**35105**	**3 Strips,** same as No. 35100, but **in daylight loading packing per tin**	
FIRUZ	**35110**	**3 Strips Cinema Negative Film** "*Perutz*" (**orthochromatic,** sensibility 16/17° SCH.) each 5¼ ft. long (for 3x36=108 exposures), **standard packing,** in one light-proof tin **per tin**	
FIRTA	**35115**	**3 Strips,** same as No. 35110, but **in daylight loading packing per tin**	
FLIFI	**35120**	**3 Strips Cinema Negative Film** "*Perutz*"—Special *Leica* Film—**strongly sensitive to yellow-green** (17° SCH.), each 5¼ ft. long (for 3x36=108 exposures), **standard packing,** in one light-proof tin **per tin**	
FLITA	**35125**	**3 Strips,** same as No. 35120, but **in daylight loading packing per tin** **Note:** *Orthochromatic Film should preferably be used with yellow filter.*	
ELDIA	**35550**	**Printing Apparatus,** for printing negative film strips on positive film and *Bromaryt-Bromide* paper **Note:** *For complete description of above see page 281.*	
ELDOS	**35560**	**3 Strips Diapositive Film** "*Agfa*", each 5¼ ft. long (for 3x36=108 positives), standard packing in one light-proof tin **per tin**	
EBROM	**35565**	**1 Roll** "*Bromaryt-Bromide*" **Paper,** 5¼ ft. long and 1⅜ in. wide	
ULEJA	**25620**	**Film Slide Projector** "*Uleja,*" with film window for **picture size 1x1⅜ in.,** with lamp 200-watt, 110-volt, complete with cord and plug **Note:** *For complete description of above, see page 257.*	
RADHI	**25646**	**Rheostat,** for No. 25620 when used on 220-volt circuit	
ULFEN	**25625**	**Film Window** for No. 25620 when using **standard cinema picture size ¾x1 in**	
ELRUK	**25652**	**Lamp Bulb,** 200-watt, 110-volt **Note:** *When ordering, state voltage of supply current.*	
ELRYN	**25604**	**Carrying Case** for No. 25620, with film case for 15 rolls **Note:** *For suitable Enlarging Apparatus for pictures taken with the Roll Film Micro Attachment Camera, refer to those listed on page 282.*	
MIFOANSA	**27710**	**Roll Film Adapter** (representing the housing of camera No. 27700), attachable to the cameras "*Macca*" and "*Makam*" Nos. 22719, 22721, 22730 and 22732; by means of this adapter, the attachment cameras "*Macca*" and "*Makam*" can be converted into roll film cameras similar to No. 27700 for use with standard cinema film	

The Complete Assortment of LEITZ PHOTO-MICROGRAPHIC APPARATUS Is Listed in CATALOG 50-G

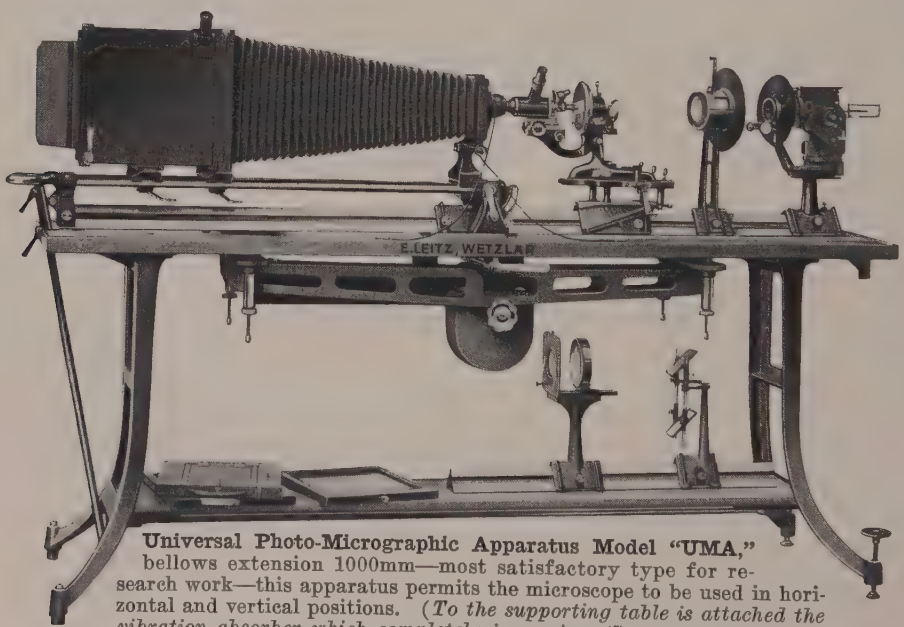
The Leitz Works are recognized as offering the most complete line of Photo-Micrographic Apparatus from the small attachment cameras (listed on preceding pages) to the most complete instruments for research work (Model "UMA"). In the following, we illustrate a few of the apparatus of which a full description is found in Catalog 50-G, copy of which will be forwarded, without charge, upon request.



Universal Photo-Micrographic Apparatus Model "MA-II," bellows extension 500mm, permitting microscope to be used in horizontal and vertical positions.

(*Apparatus shown resting upon vibration absorber*)

Photo-Micrographic Apparatus Model "MA-IV"—standard for routine laboratory work; this model is supplied in two different bellows extensions: viz., 250 and 500mm.



Universal Photo-Micrographic Apparatus Model "UMA," bellows extension 1000mm—most satisfactory type for research work—this apparatus permits the microscope to be used in horizontal and vertical positions. (*To the supporting table is attached the vibration absorber which completely immunizes the apparatus against any existing vibrations within the laboratory.*)

MICROTOMES and ACCESSORIES

In the laboratory of the scientist, the microtome occupies a place equally as important as does the microscope. Even while the microtome is an instrument of purely mechanical construction, in its workmanship, it has to be minutely accurate. **The experience the Leitz Works gained in the manufacture of optical instruments has placed them in the foremost rank to construct a variety of microtome models of utmost precision and unfailing accuracy.**

Amongst the extensive line of Leitz microtome models, a type will be found listed to meet every possible requirement in a satisfactory manner.

The **Base Sledge Microtome No. 1200** (*page 206*) is characteristic due to its great amount of stability accomplished by a heavy object sledge moving upon a solid base-plate and the knife being held by two rigid clamps at both ends. The movement of the object sledge as well as the feeding mechanism controlling the thickness of the section is jointly accomplished by one hand and **it consequently follows that this microtome is one of quick action.** *Due to its utmost stability, it will permit cutting sections of extremely hard objects.*

The **Series of Sledge Microtomes Nos. 1201-1210** is of novel design and the construction provides a knife block having bearing surfaces arranged at right angles to each other. This feature precludes the common experience with microtomes of other make that in cutting hard substances, the knife block is displaced sideways.

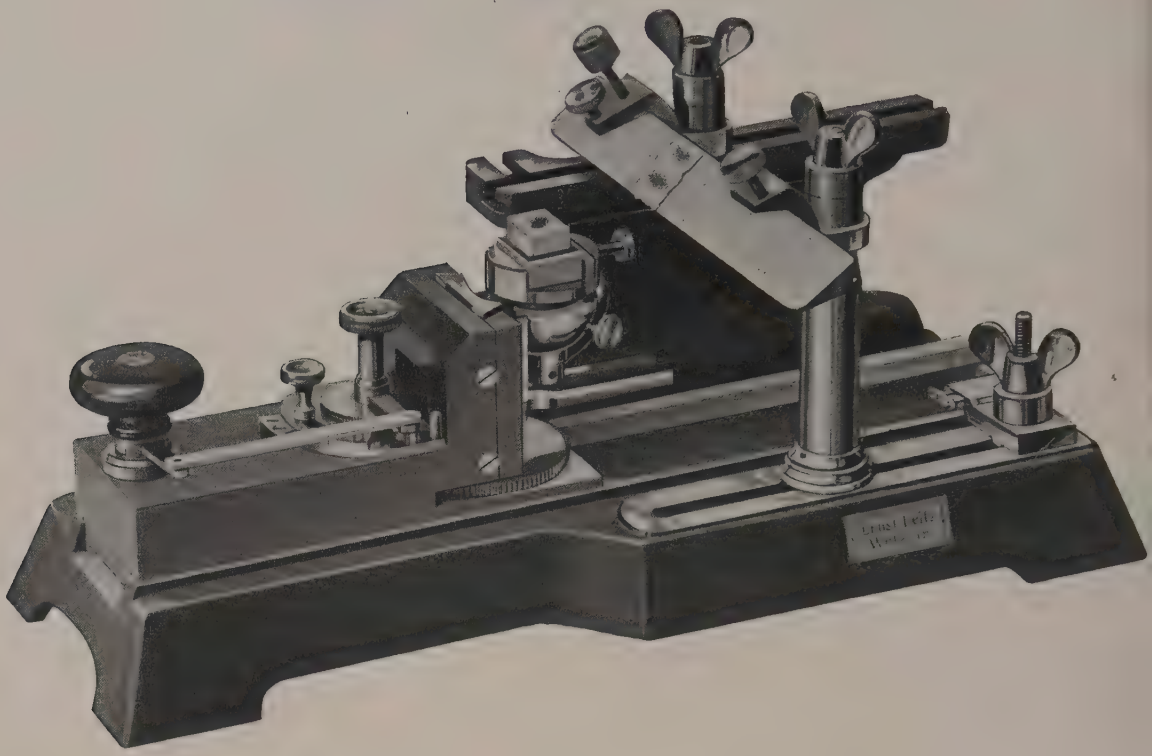
The **Sledge Microtome No. 1201** (*page 207*) is particularly constructed for *research section work* and offers special advantages for cutting objects imbedded in celloidin.

The **New Rotary Microtome,** in protective casing, **No. 1210-k** (*page 211*), represents a type recently introduced and is especially recommended for precision section work when a microtome is desired for rapid sectioning of specimens imbedded in paraffin.

Special attention is furthermore directed to different models of **Large Freezing Stages after Dr. Christeller** listed on page 216. By means of these, quick diagnosis can be obtained in cases of urgency. These stages offer the pathologist an opportunity to demonstrate on large sections the condition of typical changes in cell structure incident to carcinomae, etc., while at the same time, these sections are equally well available for precise diagnosis.

BASE SLEDGE MICROTOME

Recommended for Precision Work on Hard Objects



No. 1200

Length of track 50cm

The Base Sledge Microtome has been arranged in its construction to offer maximum stability and at the same time quick action for rapid sectioning. The sliding track is part of the solid base-plate upon which glides the heavy object block. The latter carries the feeding mechanism. The knob of the block serves as handle and in turning the knob during the backward motion of the block, the object is raised within the number of microns desired. (*One interval of the dial plate at the object block corresponds to one micron, permitting feeding of the section within a range of 1-20 microns.*)

The **Object Clamp** is of ball-socket type and affords a rapid orientation of the object. In order to raise the object quickly to its desired position, the clamp is provided with a clutch, made to disengage the micrometer screw.

The Base Sledge Microtome can be used for paraffin, celloidin and frozen sections, while it is furthermore particularly adapted for cutting hard substances.

Code Word	Cat. No.	Designation	Price
TATOM	**1200**	**Base Sledge Microtome,** as described, with ball-socket object clamp No. 1225 **for specimens up to 26mm diameter,** two knife clamps and knife protector No. 1245, *without knife*.....	$
TATOMTREGO	**1200d**	**Base Sledge Microtome,** same as No. 1200, but with object clamp No. 1225a **for specimens up to 60mm diameter**....	
TATOMTREPE	**1200e**	**Base Sledge Microtome,** same as No. 1200, but with Naples object clamp No. 1224.....	

Note: The above Microtomes can be supplied with **knife clamps No. 1227a** in place of those listed with the above equipments, **additional price,** $.

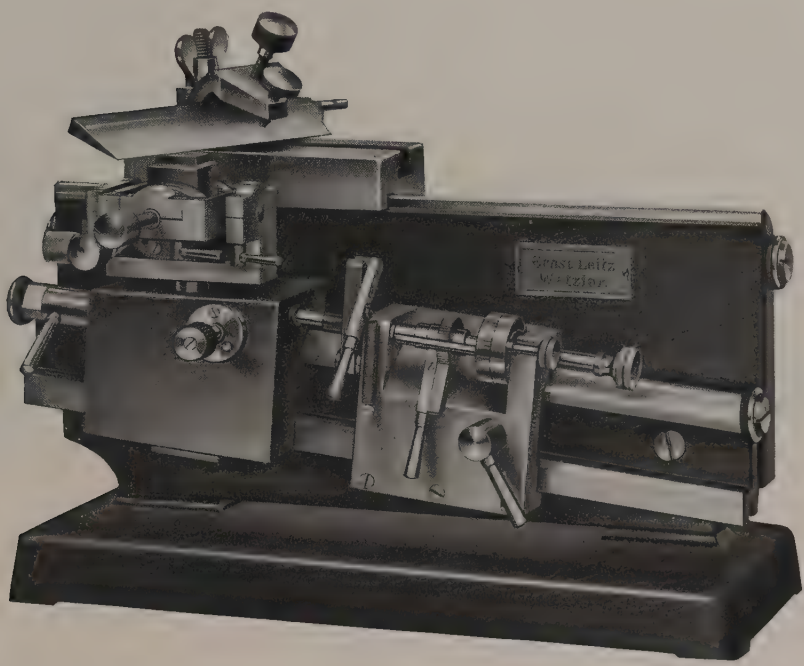
(*For suitable Freezing Apparatus refer to page 215; for suitable Knives, etc., to pages 217-219.*)

LARGE SLEDGE MICROTOME

With Inclined Surface for Micrometer Adjustment and New Improved Knife Block Movement

For Research Section Work—Most Satisfactory Type for Celloidin Specimens

Patented



No. 1201
Length of track 32cm

This microtome is provided with an inclined sliding surface for the micrometer adjustment. The micrometer slider may be locked upon its track at any desired position relative to the object block. This mechanism functions in such a manner that the micrometer screw rests against the object block and pushes it forward upon the symmetrically inclined track whereby the specimen is raised according to the thickness of section desired; a variation of thickness within the limits of 1-20 microns being possible. The micrometer feeding mechanism is of semi-automatic type since by means of lever transmission, the lever will by a single motion raise the object by as many microns as the screw has been adjusted for.

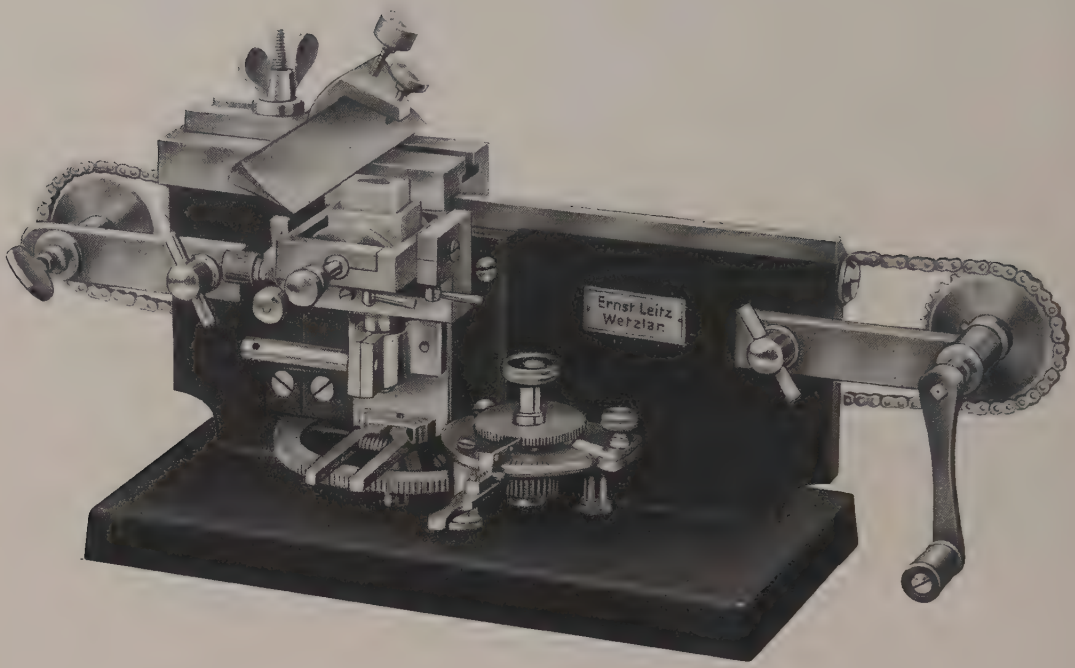
The improved knife block lends to the Microtome an unequalled rigidity.

Code Word	Cat. No.	Designation	Price
TEMON	**1201**	**Large Sledge Microtome,** as described, with ball-socket object clamp No. 1225 **for specimens up to 26mm diameter,** rack and pinion at object block for quick orientation of specimen, knife clamp No. 1226, *without knife*	$
TEMONTREGO	**1201e**	**Large Sledge Microtome,** same as No. 1201, but with object clamp No. 1225a **for specimens up to 60mm diameter**	
TEMONTREPE	**1201f**	**Large Sledge Microtome,** same as No. 1201, but with Naples object clamp No. 1224	

(For suitable Freezing Apparatus refer to page 215; for suitable Knives, etc., to pages 217-219.)

LARGE SLEDGE MICROTOME

Patented



No. 1202

Length of track 32cm

The micrometer feeding mechanism of this microtome is accomplished by a micrometer screw manipulated through transmission gears. The thickness of section can be adjusted within the range of 1-20 microns. A single movement of the lever, acting upon the micrometer disc, raises the object within those limits for which the micrometer has been adjusted. A clutch permits the object block to disengage the micrometer screw and affords the specimen a quick orientation.

Microtome No. 1202 is equipped with chain movement consisting of two brackets, supplied with wheels, a chain and handle. This device lends an even and accurate motion to the knife block, not attainable if the block is moved by hand.

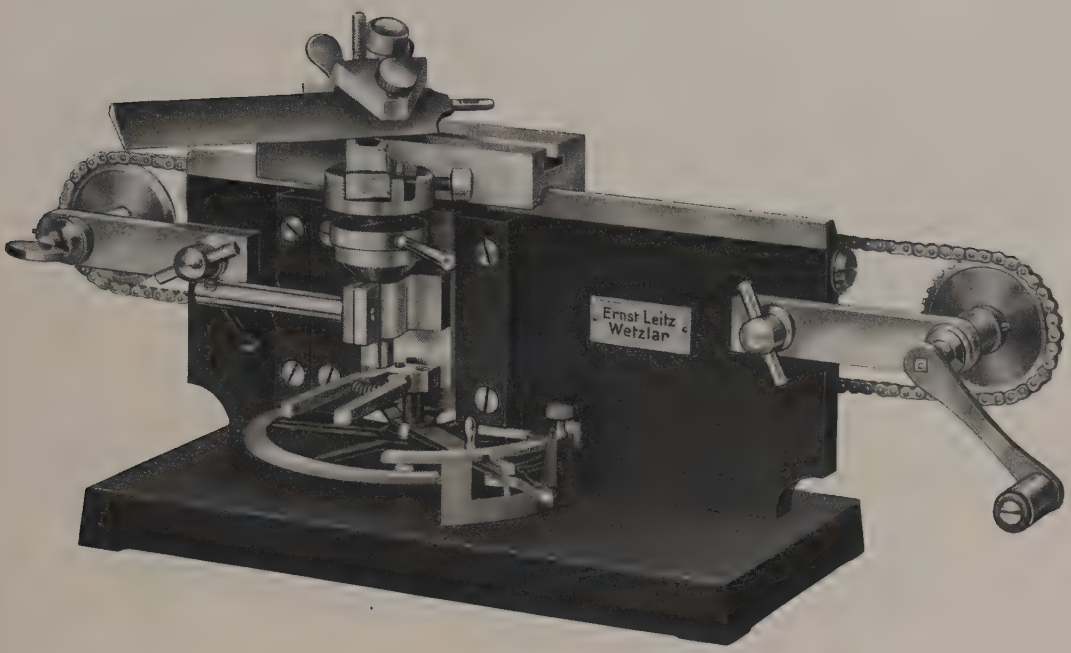
The improved knife block movement adds extreme rigidity.

Code Word	Cat. No.	Designation	Price
TIMOR	**1202**	**Large Sledge Microtome,** as described, ***with*** *chain movement,* with ball-socket object clamp No. 1225 **for specimens up to 26mm diameter,** knife clamp No. 1226, *without knife*.....	$
TIMORTREGO	**1202c**	**Large Sledge Microtome,** same as No. 1202, but with object clamp No. 1225a **for specimens up to 60mm diameter**..	
TIMORTREPE	**1202d**	**Large Sledge Microtome,** same as No. 1202, but with Naples object clamp No. 1224.....	
TIGIS	**1204**	**Large Sledge Microtome,** as described ***without*** *chain movement,* the knife block being operated by hand, with ball-socket object clamp No. 1225 **for specimens up to 26mm diameter,** knife clamp No. 1226, *without knife*.....	
TIGISTREGO	**1204a**	**Large Sledge Microtome,** same as No. 1204, but with object clamp No. 1225a **for specimens up to 60mm diameter**....	
TIGISTREPE	**1204b**	**Large Sledge Microtome,** same as No. 1204, but with Naples object clamp No. 1224.....	

(*For suitable Freezing Apparatus refer to page 215; for suitable Knives, etc., to pages 217-219.*)

LARGE SLEDGE MICROTOME

Patented



No. 1206

Length of track 32cm

This microtome is equipped with a simplified, semi-automatic adjustment for the micrometer feeding mechanism. The thickness of section may be varied within the limit of 1-20 microns. A single movement of the micrometer lever adjusts the specimen for as many microns as desired within the range indicated. By means of a clutch, the object block may be made to disengage the micrometer screw, thereby affording the specimen quick orientation.

The microtome is equipped with chain movement consisting of two brackets, supplied with wheels, a chain and handle. This device lends an even and accurate motion to the knife block, not attainable if the block is moved by hand.

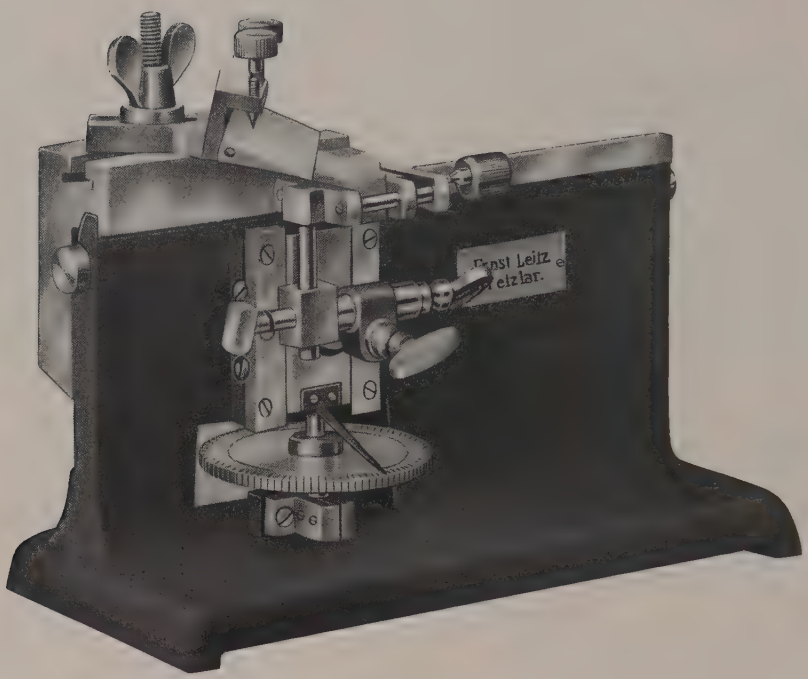
Through the improved knife block, the Microtome is endowed with maximum rigidity.

Code Word	Cat. No.	Designation	Price
TOMOK	**1206**	**Large Sledge Microtome,** as described, ***with*** *chain movement,* with ball-socket object clamp No. 1225 **for specimens up to 26mm diameter,** knife clamp No. 1226, *without knife*.....	$
TOMOKTREGO	**1206c**	**Large Sledge Microtome,** same as No. 1206, but with object clamp No. 1225a **for specimens up to 60mm diameter**....	
TOMOKTREPE	**1206d**	**Large Sledge Microtome,** same as No. 1206, but with Naples object clamp No. 1224.....	
TODIK	**1208**	**Large Sledge Microtome,** as described, ***without*** *chain movement,* the knife block being operated by hand, with ball-socket object clamp No. 1225 **for specimens up to 26mm diameter,** knife clamp No. 1226, *without knife*.....	
TODIKTREGO	**1208a**	**Large Sledge Microtome,** same as No. 1208, but with object clamp No. 1225a **for specimens up to 60mm diameter**....	
TODIKTREPE	**1208b**	**Large Sledge Microtome,** same as No. 1208, but with Naples object clamp No. 1224.....	

(*For suitable Freezing Apparatus refer to page 215; for suitable Knives, etc., to pages 217-219.*)

SMALL SLEDGE MICROTOME

Patented



No. 1210

Length of track 26cm

This microtome is offered as an inexpensive model, being of smaller design and simplified in its construction.

The specimen is adjusted by turning the dial disc by hand. The disc is provided with 100 teeth and each tooth represents 5 microns from which it follows that the sections can be cut within steps of 5 microns each. The object clamp has multiple joints and consequently affords the specimen means of universal movement. Each joint of the object clamp carries a heavy screw for holding the oriented position rigidly.

This Microtome is likewise supplied with the improved knife block movement by which extreme rigidity is guaranteed.

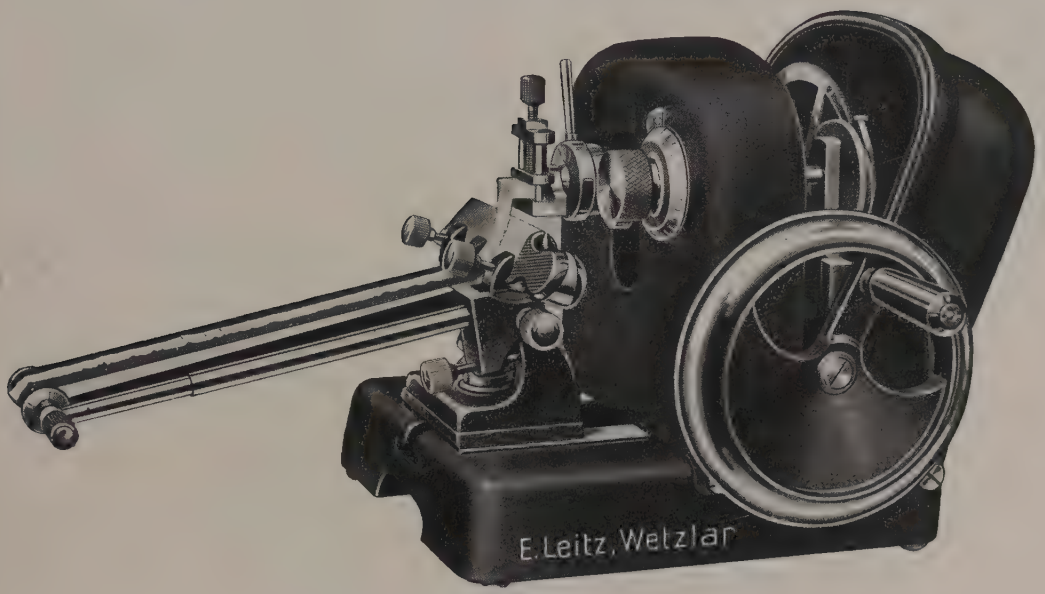
Code Word	Cat. No.	Designation	Price
TUMOS	**1210**	**Small Sledge Microtome,** as described, with simple object clamp having cross movement joints, *without knife*	$

Note: As suitable **knife clamp,** we recommend **No. 1226** (page 216).

(*For suitable Freezing Apparatus refer to page 215; for suitable Knives, etc., to pages 217-219.*)

NEW "MINOT" AUTOMATIC ROTARY MICROTOME

Closed Form in Protective Metal Casing



No. 1210-k
(*Illustrating Ribbon Carrier No. 1216 Attached*)

The general construction of the rotary microtome No. 1211 (*listed on page 212*) has been made the basis for this model. The micrometer feeding mechanism is one of utmost precision. The ratchet has a central bearing by means of which it engages the teeth at the wheel in a radial fashion and consequently materially reduces the wear upon the teeth so commonly recognized with other rotary microtomes. The micrometer mechanism can be very easily and rapidly adjusted to the thickness of section desired. An adjustment within the range of 1-25 microns, and this within steps of one or more microns, is readily accomplished. The transmission of the ratchet wheel by one tooth corresponds to a displacement of the specimen by one micron.

So as to protect the mechanism of the microtome against dust and accidental injury, and furthermore to prevent paraffin-waste, or alcohol, etc., from entering, the microtome is enclosed by a metal housing so arranged that the one half can be readily swung back to gain access to the mechanism itself.

At the front wall of the microtome housing a graduated dial with knob is situated to serve adjustment to the desired thickness of section while the microtome casing is closed. The object clamp is held in a ball joint and is there clamped tightly by means of a strong lever. This insures the specimen against vibration while sections are being cut and the ball joint affords at the same time an exceedingly quick orientation of the specimen relative to the knife.

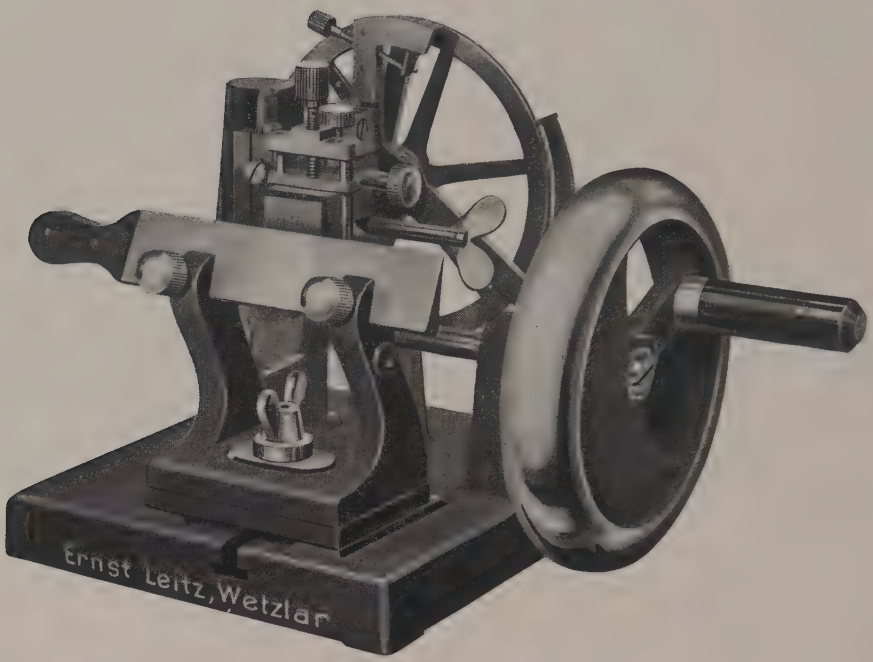
For use with the microtome, we recommend the knife No. 1234 (*listed on page 218*), while at the same time *"Gillette"* blades in connection with holder No. 1262 (*listed on page 218*) can likewise be utilized.

Code Word	Cat. No.	Designation	Price
TABIM	**1210-k**	**New Rotary Microtome—*Closed Model*—in protective metal casing,** as described, with knife block permitting cross motion in relation to the specimen, object clamp with ball-socket, two object discs, *without knife*	$

(*For suitable Knives, etc., refer to pages 217-219*)

"MINOT" AUTOMATIC ROTARY MICROTOME

Improved Form



No. 1211

While this microtome represents the conventional type of *"Minot"* rotary pattern, it has been greatly improved in respect to the micrometer feeding mechanism. The ratchet has a central bearing by means of which it engages the teeth at the wheel in a radial fashion and consequently materially reduces the wear upon the teeth so commonly recognized with *"Minot"* microtomes of other make. The micrometer mechanism can be very easily and rapidly adjusted to the thickness of section desired. An adjustment within the range of 1-25 microns, and this within steps of one or more microns, is readily accomplished. The transmission of the ratchet wheel by one tooth corresponds to a displacement of the specimen by one micron.

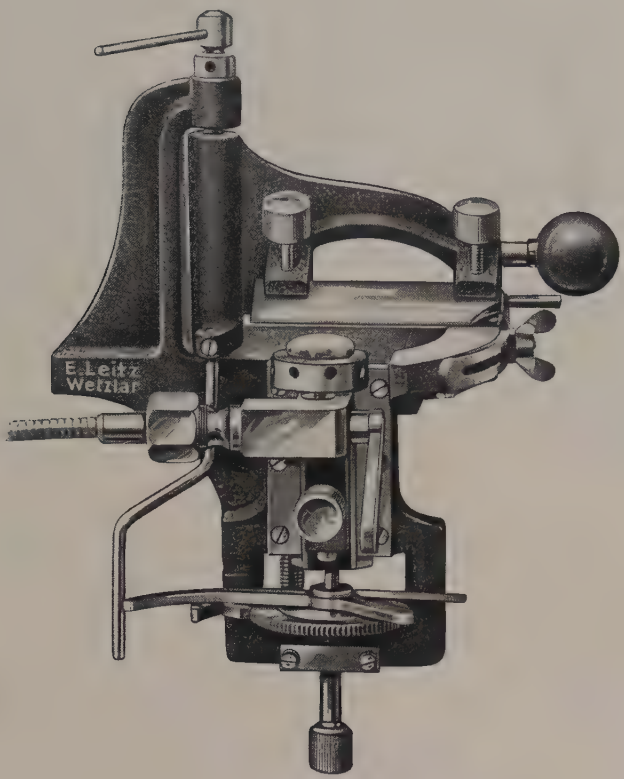
The object clamp is of the cross motion type provided with multiple joints affording the object universal means of orientation. Each joint carries a heavy screw for holding the oriented position rigidly.

Code Word	Cat. No.	Designation	Price
TYMOT	**1211**	**"Minot" Microtome,** as described, with knife block permitting cross motion in relation to the specimen, object clamp with universal joint, two object discs, *without knife*	$

(*For suitable Knives, etc., refer to pages 217-219.*)

AUTOMATIC FREEZING MICROTOME

CO_2 Method



No. 1213

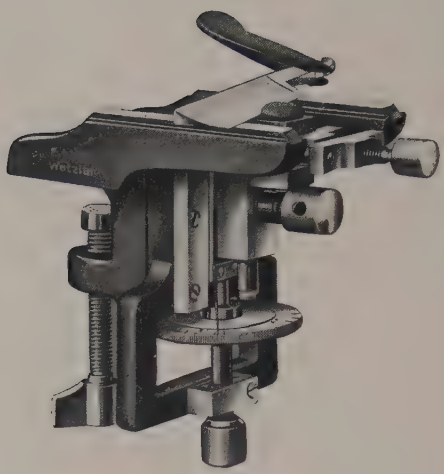
This microtome has been designed especially for the cutting of frozen sections by the CO_2 method; however, it is at the same time available for paraffin as well as celloidin sections. The knife clamp constitutes a handle mounted to the vertical frame by pivoted screws. A radial track has been provided upon which the knife clamp glides in a semi-circular fashion. Such a construction assures extreme rigidity while sectioning frozen objects which naturally represent hard substances.

The adjustment of the section to the desired thickness is accomplished automatically and this within a ratio of 5-50 microns. The graduated circle is provided with ten lines, each line representing five microns. In moving the knife block, it touches in its back motion against the feeding mechanism and consequently transmits automatically a movement upon the specimen by as many microns for which the mechanism has been regulated. In addition to the automatic motion the object can likewise be adjusted by hand in manipulating the spindle head of the micrometer screw. One interval at the divided disc, attached to the micrometer screw, equals ten microns and when adjusting the specimen by hand, the thickness of section has to be read at the micrometer dial.

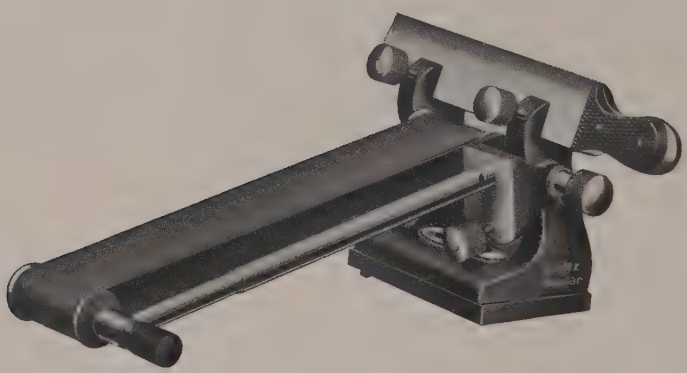
Code Word	Cat. No.	Designation	Price
TOFRI	**1213**	**Automatic Freezing Microtome,** as described, with simple object clamp and one object disc, *without knife*.....	$
TOFRITROLE	**1213c**	**Automatic Freezing Microtome,** same as No. 1213, with the addition of CO_2 freezing apparatus No. 1219.....	

(For suitable Knives, etc., refer to pages 217-219.)

No. 1215



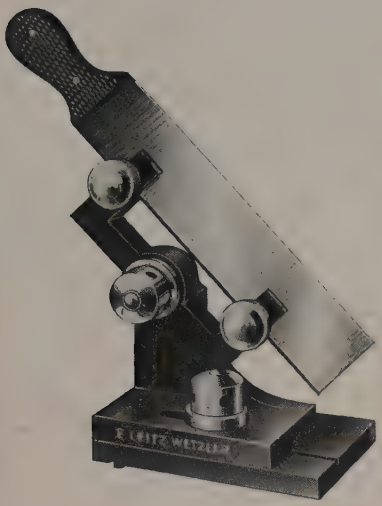
No. 1214



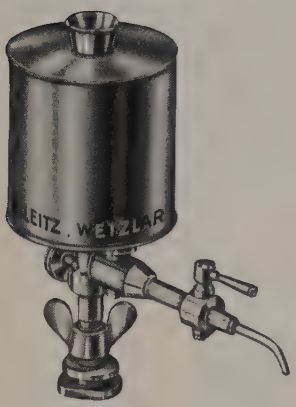
No. 1216

Code Word	Cat. No.	Designation	Price
TARTU	**1214**	**Table Microtome,** with simple object clamp, one object disc; the microtome being provided with a heavy clamping screw for attaching to table top; two glass tracks mounted horizontally serve the knife as gliding surface; the specimen is adjusted in turning the micrometer dial by hand; one interval of the dial corresponds to a displacement within steps of ten microns; *without knife*	$
TYLIN	**1215**	**Cylindrical Hand Microtome,** with object clamp provided with screw device to hold the specimen, round stage with attached glass plate of 70mm diameter, serving as gliding surface to the knife; the object is adjusted by turning the knurled micrometer dial of which one interval corresponds to a displacement of the specimen within ten microns; all metal parts are heavily nickel-plated; *without knife*	
TRABA	**1216**	**Ribbon Carrier** for cutting series of sections	

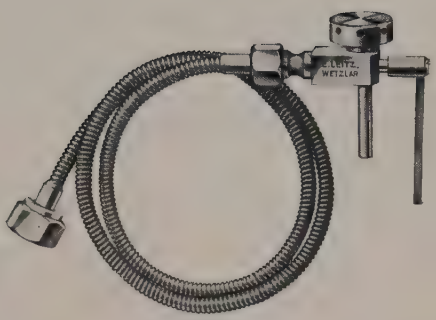
(*For suitable Knives, refer to pages 217-219.*)



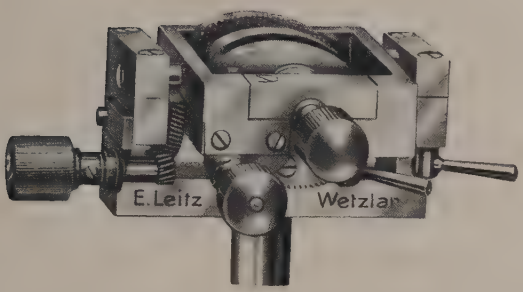
No. 1217



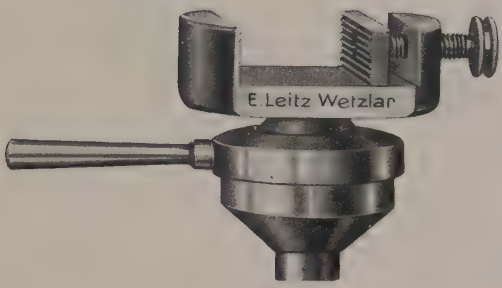
No. 1218



No. 1219

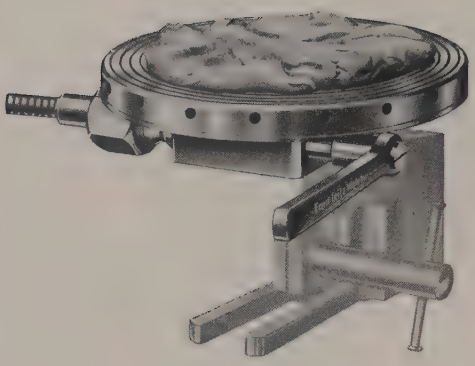


No. 1224



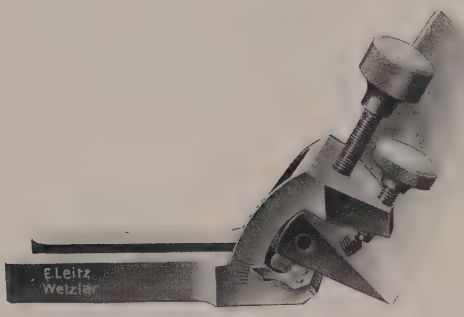
No. 1225

Code Word	Cat. No.	Designation	Price
TRAKO	**1217**	**Inclinable Knife Block** permitting the knife of the "*Minot*" microtomes Nos. 1210k and 1211 to be tilted at an angle for celloidin sectioning...	$
TROPF	**1218**	**Dropping Apparatus** for alcohol, when sectioning celloidin specimens, *for use with microtomes Nos. 1200 to 1210*.....	
TROLE	**1219**	**Freezing Apparatus CO_2,** which by means of a corrugated metal tubing attaches itself to the CO_2 cylinder; the freezing surface of the chamber is of **35mm diameter.** (*This apparatus freezes specimens within a few seconds.*)..... **Note:** *The Freezing Chamber No. 1219 can be used with microtomes Nos. 1201 to 1210 and No. 1213; when ordering, the microtome for which it is desired has to be stated.*	
TROSA	**1219a**	**Freezing Apparatus CO_2,** same as No. 1219 but with freezing surface of **90mm diameter** *for use with Base Sledge Microtome No. 1200*.....	
TREPE	**1224**	**Naples Object Clamp,** having universal adjustment by two rack and pinion movements; permitting the specimen to be oriented with utmost precision; two levers arrest the oriented position securely. (*The Naples Clamp can be used with microtomes Nos. 1200 to 1208b.*).....	
TREKU	**1225**	**Ball-Socket Object Clamp** consisting of two hemispherical segments of which the upper one serves as cover, a steel ball within the interior carries the object clamp proper; the lever attached to the upper segment permits the cover to clamp the ball rigidly in place; the clamp accommodates **specimens up to 26mm diameter.** (*For microtomes Nos. 1200 to 1208b.*).....	
TREGO	**1225a**	**Ball-Socket Object Clamp,** same as No. 1225, but for **specimens up to 60mm diameter**.....	

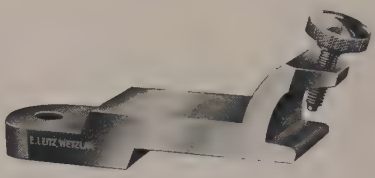


No. 1220

No. 1220a

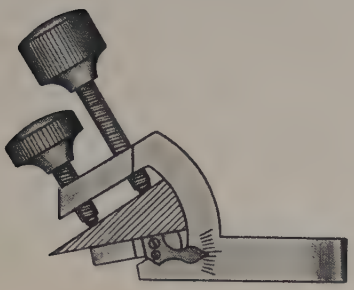


No. 1226

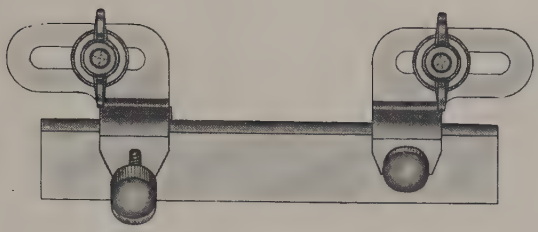


No. 1229

Code Word	Cat. No.	Designation	Price
TROFI	**1220**	**CO_2 Freezing Chamber after** *Dr. Christeller*, **circular form,** with freezing surface of **120mm diameter** permitting the use of large specimens; complete with corrugated metal tubing for connection to CO_2 cylinder (*For use with microtomes Nos. 1201 to 1208b.*) . .	$
TRONO	**1220a**	**CO_2 Freezing Chamber after** *Dr. Christeller*, **rectangular form,** with freezing surface **90x130mm;** complete with corrugated metal tubing for connection to CO_2 cylinder. (*For use with microtome No. 1200.*) . . . . . The Freezing Cabinets Nos. 1220b, 1220c and 1220d represent devices suggested by *Dr. Christeller* as aid for his freezing methods; these cabinets afford a complete isolation against exterior temperature influence and consequently the freezing of even large sections with chambers Nos. 1220 and 1220a, is readily and quickly accomplished. (*Refer to book edited by Dr. Erwin Christeller entitled "Atlas der Histotopographie gesunder und erkrankter Organe,"* Publisher Georg Thieme, Leipzig.)	
TRODT	**1220b**	**CO_2 Freezing Cabinet** for freezing chamber after *Dr. Christeller* No. 1220	
TROTY	**1220c**	**CO_2 Freezing Cabinet** for freezing chamber after *Dr. Christeller* No. 1220a	
TABYMENO	**1220d**	**CO_2 Freezing Cabinet** for freezing chamber No. 1219	
TROVU	**1221**	**Collapsible Stand** for CO_2 cylinder, of solid construction	
TRAME	**1226**	**Knife Clamp with Adjustable Support** for knife, having index by which to read the correct angle of the knife; by means of this improved clamp the knife can be readily oriented to its correct position. (*For use with microtomes Nos. 1201 to 1210.*)	
TRALY	**1229**	**Knife Clamp, Simple Model, with Stationary Support** for knife, for celloidin sections. (*For use in connection with base sledge microtome No. 1200.*)	
TRAYM	**1229b**	**Knife Clamp,** same as No. 1229, but with extension arm and adjustable support for knife; this clamp, *when used on base sledge microtome No. 1200,* permits for celloidin sections an increased slant to the knife	



Side view



Top view, showing knife attached

No. 1227a

Code Word	Cat. No.	Designation	Price
TACAMURA	**1227a**	**Set of Two Knife Clamps,** *for base-sledge microtome No. 1200,* with guiding slit bent at an angle, each clamp with adjustable support for knife and index for reading knife inclination; by means of the guiding slit being bent at an angle, the clamps permit the use of shorter knives and shifting them for complete use of the cutting edge.....	$

MICROTOME KNIVES

Aside from the precision construction of a microtome and its stability towards rendering satisfactory sections, a perfect quality of the microtome knives is of similar importance. The Leitz Works have undertaken extensive research in respect to finding a most satisfactory grade of microtome knife and those which are listed in the following are known as representing a quality which surpasses the general range of microtome knives **due to a superior stage of tempering and fineness of knife edge.**

An erroneous impression seems to prevail generally that a knife offered for paraffin sections is likewise adaptable for frozen specimens and a knife constructed for celloidin sectioning, for paraffin specimens, or vice versa. In order to obtain the maximum efficiency in section work, the knife for the one or other mode of cutting should be exclusively used for the specific kind of specimen for which the knife was originally ordered. We supply three different grades of knives and each distinguishes itself from the others in respect to the taper of the blade or knife edge respectively..

Grinding A

Represents a knife of strongly plano-concave profile, **recommended for celloidin sections.**

Grinding B

Represents a knife of plano-concave profile, the concave surface being less pronounced than in grinding A; this being **recommended for paraffin sections.**

Grinding C

Has two plano surfaces and its cutting edge is less slanted; this type is **solely recommended for frozen sections.**

Aside from the various profiles outlined under grinding A, B and C, for the different section methods for which the knives are offered, they are furthermore especially tempered to meet the individual requirements for which the section work involved calls.

Nos. 1230, 1230-1, 1230-2

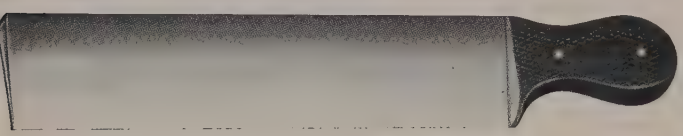
Nos. 1231 to 1231-17

(For prices of Microtome Knives, see page 218)

MICROTOME KNIVES—(Continued)

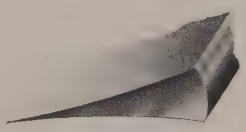
Code Word	Cat. No.	Designation	Price
TRINUTRIFF	**1230**	**Microtome Knife,** special knife *for base-sledge microtome Nos. 1200 to 1200e,* blade 24cm, grinding **A,** in case	$
TRINUTRILL	**1230-1**	**Microtome Knife,** same as No. 1230, but grinding **B**	
TRINUTRIMM	**1230-2**	**Microtome Knife,** same as No. 1230, but grinding **C**	
TRIGETRIFF	**1231**	**Microtome Knife,** *"Jung"* pattern, blade 24cm, grinding **A,** in case	
TRIGETRILL	**1231-1**	**Microtome Knife,** same as No. 1231, but grinding **B**	
TRIGETRIMM	**1231-2**	**Microtome Knife,** same as No. 1231, but grinding **C**	
TRITETRIFF	**1231-3**	**Microtome Knife,** *"Jung"* pattern, blade 20cm, grinding **A,** in case	
TRITETRILL	**1231-4**	**Microtome Knife,** same as No. 1231-3, but grinding **B**	
TRITETRIMM	**1231-5**	**Microtome Knife,** same as No. 1231-3, but grinding **C**	
TRICATRIFF	**1231-6**	**Microtome Knife,** *"Jung"* pattern, blade 16cm, grinding **A,** in case	
TRICATRILL	**1231-7**	**Microtome Knife,** same as No. 1231-6, but grinding **B**	
TRICATRIMM	**1231-8**	**Microtome Knife,** same as No. 1231-6, but grinding **C**	
TRIXITRIFF	**1231-9**	**Microtome Knife,** *"Jung"* pattern, blade 14cm, grinding **A,** in case	
TRIXITRILL	**1231-10**	**Microtome Knife,** same as No. 1231-9, but grinding **B**	
TRIXITRIMM	**1231-11**	**Microtome Knife,** same as No. 1231-9, but grinding **C**	
TRIUSTRIFF	**1231-12**	**Microtome Knife,** *"Jung"* pattern, blade 12cm, grinding **A,** in case	
TRIUSTRILL	**1231-13**	**Microtome Knife,** same as No. 1231-12, but grinding **B**	
TRIUSTRIMM	**1231-14**	**Microtome Knife,** same as No. 1231-12, but grinding **C**	
TRIAZTRIFF	**1231-15**	**Microtome Knife,** *"Jung"* pattern, blade 8cm, grinding **A,** in case	
TRIAZTRILL	**1231-16**	**Microtome Knife,** same as No. 1231-15, but grinding **B**	
TRIAZTRIMM	**1231-17**	**Microtome Knife,** same as No. 1231-15, but grinding **C**	

Note: If knives are desired **without case, deduct,** according to size, $ to $.



No. 1234

Nos. 1260-1263



No. 1234
Profile

Code Word	Cat. No.	Designation	Price
TAUTO	**1234**	**Microtome Knife,** special knife *for "Minot" microtomes Nos. 1210k and 1211,* both surfaces concave, blade 150mm, back 13mm, in case **Note:** If knife is desired **without case, deduct**	$
TAUCY	**1236**	**Large Knife** *for table and hand microtomes Nos. 1214 and 1215,* surfaces plano-concave, with arrangement for locking handle and blade	
TAURA	**1237**	**Razor Knife** *for table and hand microtomes Nos. 1214 and 1215,* surfaces plano-concave	
TACEMASI	**1260**	**Holder** for razor blades of *"Gillette"* and similar types, suitable *for the base-sledge microtome No. 1200*	
TACIMOSA	**1261**	**Holder,** same as No. 1260, but suitable *for use with sledge microtomes Nos. 1201 to 1210*	
TACOMACA	**1262**	**Holder,** same as No. 1260, *for "Minot" microtomes Nos. 1210k and 1211*	
TACUMERE	**1263**	**Holder,** same as No. 1260, *for freezing microtomes Nos. 1213-1213c*	
TACYMORN	**1264**	**Holder,** same as No. 1260, however, with handle, suitable *for table microtome No. 1214*	
TRALU	**1265**	**Holder,** same as No. 1260, however, with handle, *for hand microtome No. 1215*	

ACCESSORIES for HONING and STROPPING of MICROTOME KNIVES

In order to hold the knife conveniently during honing and stropping, we recommend knife handle No. 1238.

Dependent upon the profile (grinding) of the microtome knife, an appropriate type of stropping device is recommended. The knives of grinding B and C are to be provided with the tubular back No. 1240 for honing and stropping, whereas knives of grinding A are used with sharpening device of wire form No. 1239. For knives of which the blade surfaces are both concave (*"Minot"* microtome knife No. 1234), a honing and stropping device is not required.

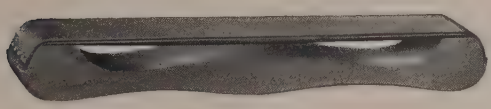
In order to obtain an edge of proper keenness, particular attention is drawn to the use of hones and strops of only satisfactory quality.

No. 1238

No. 1239

No. 1240

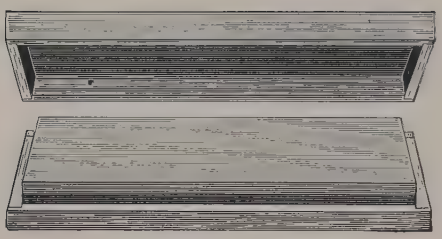
Code Word	Cat. No.	Designation	Price
TAUGI	**1238**	**Sharpening Handle,** ebony wood. (*For use with knives "Jung" pattern Nos. 1231 to 1231-17.*)	$
TAUPU	**1238a**	**Sharpening Handle,** ebony wood. (*For use with knives Nos. 1230 to 1230-2.*)	
		Sharpening Device in wire form, Nos. 1239 to 1239-5, is for use with knives, grinding A.	
TRACK	**1239**	**Sharpening Device,** wire form, for knife blade 24cm	
TRAPP	**1239-1**	**Sharpening Device,** same as No. 1239, for knife blade 20cm	
TRASS	**1239-2**	**Sharpening Device,** same as No. 1239, for knife blade 16cm	
TRATT	**1239-3**	**Sharpening Device,** same as No. 1239, for knife blade 14cm	
TRAIG	**1239-4**	**Sharpening Device,** same as No. 1239, for knife blade 12cm	
TRAEF	**1239-5**	**Sharpening Device,** same as No. 1239, for knife blade 8cm	
		Sharpening Back in tubular form Nos. 1240 to 1240-5, is for use with knives, grinding B and C.	
THYGA	**1240**	**Sharpening Back,** tubular form, for knife blade 24cm	
THYBU	**1240-1**	**Sharpening Back,** same as No. 1240, for knife blade 20cm	
THYCO	**1240-2**	**Sharpening Back,** same as No. 1240, for knife blade 16cm	
THYDI	**1240-3**	**Sharpening Back,** same as No. 1240, for knife blade 14cm	
THYFE	**1240-4**	**Sharpening Back,** same as No. 1240, for knife blade 12cm	
THYRY	**1240-5**	**Sharpening Back,** same as No. 1240, for knife blade 8cm	



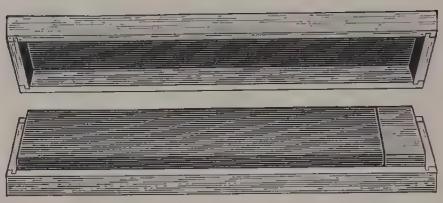
No. 1241

No. 1242

Code Word	Cat. No.	Designation	Price
THEDA	**1241**	**Bow Strop,** covered with genuine cowhide, upholstered underneath, **30**cm long	$
THEBO	**1241-1**	**Bow Strop,** same as No. 1241, **36**cm long	
THEMI	**1242**	**Strop, *"ZIMMER,"*** with four surfaces, three surfaces provided with genuine leather of different grades, one surface provided with hone, **20**cm long, **3**cm wide	
THEGE	**1242-1**	**Strop,** same as No. 1242, **20**cm long, **3.5**cm wide	
THEFU	**1243**	**Stropping Paste,** for above strops	**per tin**



Nos. 1243-1 to 1243-4



Nos. 1243-6 to 1243-7

Code Word	Cat. No.	Designation	Price
FILCN	**1243-1**	**Hone, Yellow, Belgian, 18**cm, "Selected Quality," in wooden box....	$
FILDE	**1243-2**	**Hone,** same as No. 1243-1, **20**cm	
FILEP	**1243-3**	**Hone,** same as No. 1243-1, **23**cm	
FILFU	**1243-4**	**Hone,** same as No. 1243-1, **25**cm	
FILGS	**1243-6**	**Hone, Blue-Green, 20**cm, "Selected Quality," in wooden case.....	
FILHJ	**1243-7**	**Hone,** same as No. 1243-6, **25**cm	

The fibre blocks listed under No. 1246 to 1247-3 are recommended for use with specimens imbedded in paraffin or celloidin. The surface of these blocks is provided with grooves so that proper adhesion of the imbedded specimens is assured.

Code Word	Cat. No.	Designation	Price
TABAR	**1246**	**Fibre Blocks,** $\frac{1}{2}$x$\frac{1}{2}$x$\frac{3}{4}$ in.....**per 10**	$
TABBI	**1246-1**	**Fibre Blocks,** $\frac{1}{2}$x$\frac{1}{2}$x$\frac{3}{4}$ in.....**per 100**	
TABCA	**1246-2**	**Fibre Blocks,** $\frac{5}{8}$x$\frac{5}{8}$x$\frac{3}{4}$ in.....**per 10**	
TABDE	**1246-3**	**Fibre Blocks,** $\frac{5}{8}$x$\frac{5}{8}$x$\frac{3}{4}$ in.....**per 100**	
TABET	**1246-4**	**Fibre Blocks,** $\frac{3}{4}$x$\frac{3}{4}$x$\frac{3}{4}$ in.....**per 10**	
TABFH	**1246-5**	**Fibre Blocks,** $\frac{3}{4}$x$\frac{3}{4}$x$\frac{3}{4}$ in.....**per 100**	
TABGO	**1246-6**	**Fibre Blocks,** 1x1x$\frac{3}{4}$ in.....**per 10**	
TABHU	**1246-7**	**Fibre Blocks,** 1x1x$\frac{3}{4}$ in.....**per 100**	
THUNA	**1247**	**Fibre Blocks,** mushroom type, with mounting stage 3x2$\frac{3}{8}$ in.....**ea.**	
THUSO	**1247-1**	**Fibre Blocks,** mushroom type, with mounting stage 2$\frac{3}{4}$x2 in.....**ea.**	
THUKI	**1247-2**	**Fibre Blocks,** mushroom type, with mounting stage 2$\frac{3}{8}$x2 in.....**ea.**	
THULE	**1247-3**	**Fibre Blocks,** mushroom type, with mounting stage 2x2 in.....**ea.**	

Pages 222 to 237 cover

COLORIMETERS

LEITZ COLORIMETERS

New Models

With Perfectly Symmetrical Light Rays

With the introduction of the new Leitz colorimeters, an era of increased reliability in colorimetric determinations has been established. In their construction, these new models depart from the conventional pattern and they are so arranged that through the specially designed *"Huefner"* prism, a high degree of perfection in the symmetry of the light rays is accomplished. **This feature involves the absolute guarantee that both halves in the comparison field are of identical shade, obviating the minutest error which is so commonly found with colorimeters of other manufacture.**

In general construction, the new model colorimeters resemble a microscope stand in outward appearance and in every detail of adjustment and workmanship, microscopical precision prevails. With the introduction of these colorimeters, we did not have in mind to match the low prices at which some colorimeter types are offered, but our chief concern has been to have these new models available for reliable precision work. **If the Leitz colorimeters are compared with those of other manufacture, the price difference will readily be found to be warranted.**

As is generally understood, colorimeters represent instruments for measuring the contents of solutions by the intensity of their color and by comparing solutions of unknown contents value with those of which the contents are known. Colorimetric determinations may therefore be made in all cases in which it is possible to obtain a liquid having a color sufficiently stable to last during the measuring period.

Laboratories employ the colorimeter not only for biological chemistry determinations but likewise in a multitude of other fields, such as medical analysis of blood, urine, kidney-function, etc. Industries make wide application of colorimetric methods for the determination of the amount of impurities in given substances. Oil industries employ the colorimeter in the grading of kerosene and other oils.

With the new Leitz colorimeter lamp, a most efficient and even light is obtained which further enhances the accuracy of colorimetric determinations. Emanating from a mirror reflecting the light, the pencils of rays pass vertically through the two sides of the instrument and interposed in these two pencils of rays are the substances which are to be tested. Some of the light in passing through the liquid is absorbed and the amount of absorption naturally depends on the depth of the solution. The two beams of light are brought to a common axis by means of the especially devised *"Huefner"* prism. The light from one cup illuminates one-half of the comparison field in the ocular and the light from the other cup illuminates the other symmetrically. The observing telescope (ocular) by which the field is viewed focuses upon the hair line which separates the two fields. By means of the focusing mechanism controlling the movement of the cups, the depths of the two columns of liquid are altered until the two halves of the comparison field are identical in intensity. When an equality in color is perceptible, it has to be borne in mind that the concentration of the two solutions are inversely proportional to the depths which are read on the scales at the rear of the colorimeter stand. **Two prisms, one each mounted to the two scales, permit an easy reading of the scale from the normal position the head holds during the colorimetric test.**

STANDARD COLORIMETERS

Nos. 34000-34006 and 34028-34030.

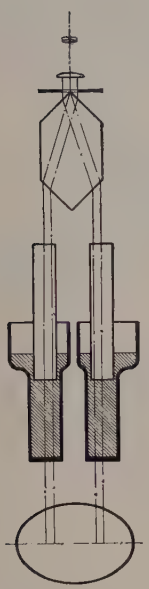


Diagram of light rays passing through the colorimeter

Prism—Consists of the new *"Huefner"* type effecting a most **perfect unison of rays in symmetrical manner** and furthermore **produces a much finer dividing line** than those prisms commonly used in other types. The *"Huefner"* prism **converges in a faultless manner** the light rays of the right and left optical axes until they gain contact in the field of vision.

Ocular—Is provided with a micrometric device of screw fitting and enables a **perfect focus** upon the hair-like dividing line of the two fields.

Rack and Pinion—For moving the plungers is provided with finely cut teeth and assures a **perfect and smooth movement** so often lacking in colorimeters of other manufacture. The knurled heads of the rack and pinion device are mounted **stationary** and do not travel up and down as in other models.

Plungers—Are made of solid optical glass free from striae or air bubbles and are **perfectly matched** in clearness of glass to safeguard correct determinations; these plungers are mounted to clamping sockets and are held by counter screw nuts to prevent accidentally dropping out.

Cups—Are provided with "over-flow" devices to prevent the liquid from running over the top when the solution is filled to the "over-flow" margin and the plungers immersed completely. The cups are held in a screw mounting assuring a perfect fitting relative to the plano glass bottoms; the cups as well as the glass bottoms may be removed for cleaning; the complete cup with screw mounting is held upon a dove-tailed metal slider for easy removal and perfect fitting.

Mirror—Is of sufficient size mounted to a universal joint and provided with one each plano mirror and ground glass surface.

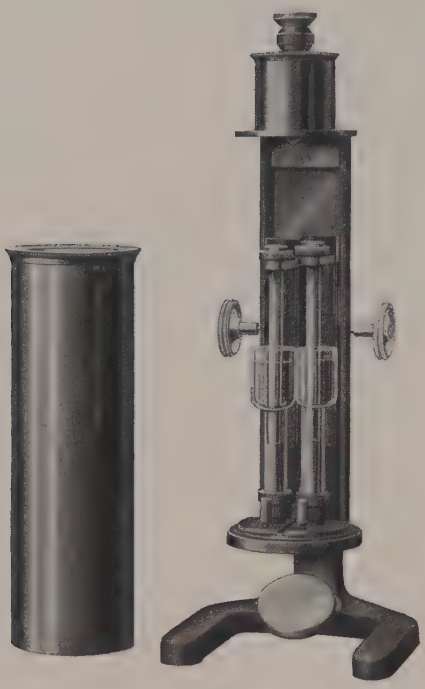
Top Reader—On each side, right and left, prisms are mounted opposite the scales and verniers allowing reading of the scales to 1/10mm from the position the head retains during observation.

Mechanical Stand—Resembles in construction and dimensions the stand of a microscope and is made with similar precision as is characteristic with Leitz microscopes; to exclude external light and to protect the optical units against injury, a metal hood is supplied which can easily be attached and removed.

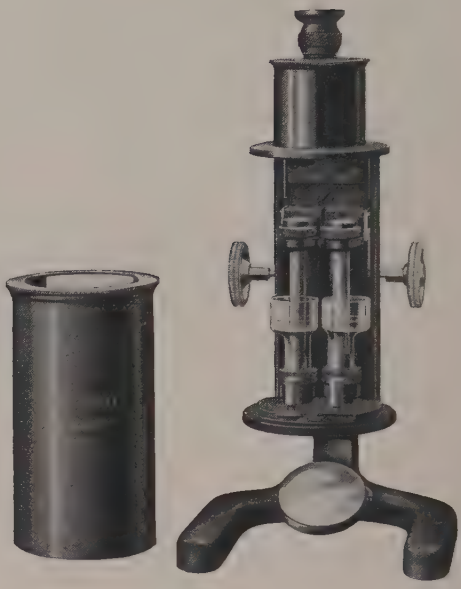
Faultless results are obtained with the new Leitz colorimeters and the exactness of reading exceeds by far the average colorimeters of other make due to the precision in optical and mechanical workmanship. **Whenever reliable colorimetric determinations are required, preference should be given to the new Leitz colorimeters for** obvious reasons.

(*Continued on page 224*)

STANDARD COLORIMETERS—(Continued)



Colorimeter with Cups 100mm
Nos. 34000-34002



Colorimeter with Cups 50mm
Nos. 34004-34006

(Colorimeter No. 34028-34030, with cups 20mm, is proportionately smaller in size)

Special Colorimeter Lamps

Colorimeter with Special Lamp No. 34124 attached

The precision of colorimetric determinations greatly depends upon perfect illumination. Artificial light is usually preferred because the irregular cloud effect of the sky often renders it difficult to establish faultless color identity. We offer illuminating devices which solve the lighting problem with colorimeters in a most ideal manner.

A: No. 34026 Illuminating Attachment, consists of a metal elbow containing an opal glass plate 50mm diameter facing the source of light. The rays emitted by the latter pass through the opal glass plate and after traversing two openings meet a plano mirror set at an angle of 45°. The rays being reflected at this mirror pass through the cups and plungers and then again through the prism to the ocular. In order to obviate reflection such as may arise in the cups or plungers respectively and this in the case of superfluous light, the openings of the illuminating attachment as well as those in the stage plate are so arranged in size as to permit transmitting only the amount of light which serves to illuminate the two semi-circles within the comparison field of the ocular. The illuminating attachment itself is divided into two halves by a partition. In the universal colorimeter as well as the standard colorimeters 50 and 100mm, the illuminating attachment fastens by means of a dove-tail to the dove-tailed slider at the under-surface of the stage, while in the standard colorimeter 20mm, the illuminating attachment is fastened by means of screws.

(Continued on page 225)

B: For use in connection with all colorimeters including the universal model, we offer the **Special Colorimeter Lamp No. 34124** which consists of a cylindrical metal housing equipped with a bulb 6-volt, 5-ampere mounted in centerable socket. This lamp fastens to the illuminating attachments Nos. 34026 and 34046 described on page 224 and renders an even and sufficiently strong source of illumination for colorimetric as well as nephelometric determinations. Inasmuch as the lamp bulb is one of low voltage, the lamp has to be naturally used with the aid of a rheostat or transformer dependent upon the available current conditions.

C: For use with the standard colorimeters as well as the hemoglobinometer *"Buerker,"* a **Special Colorimeter Lamp No. 34048** with opal bulb is supplied. This lamp fastens by means of an adapter to the illuminating attachment Nos. 34026 and 34046. The lamp bulb is not one of low voltage type and consequently, the lamp can be directly connected to the standard light circuit without the use of rheostat or transformer.

Code Word	Cat. No.	Designation	Price
HOLTA	**34000**	**Standard Colorimeter,** as described, with cups and plungers **100mm,** capacity of cups about 18cc, complete **with cabinet**	$
HEROW	**34002**	**Standard Colorimeter,** same as No. 34000, but **without cabinet**	
HOLVI	**34004**	**Standard Colorimeter,** as described, with cups and plungers **50mm,** capacity of cups about 9cc, complete **with cabinet**	
HERYN	**34006**	**Standard Colorimeter,** same as No. 34004, but **without cabinet**	
		Supplementary Parts for Micro-Colorimetry *for Colorimeters Nos. 34000-34006*	
HAFOGENO	**34008**	**Pair of Cups,** capacity about 1cc, with screw mount and dovetailed slider	$
HALACONI	**34010**	**Pair of Plungers,** 50mm long, 4mm diameter, with screw mount	
HALECOID	**34012**	**Supplementary Parts for Micro-Colorimetry, complete** (Nos. 34008-34010)	
		Replacement Parts for Nos. 34000-34010:	
HAPESAPI	34014*	Pair of Cups, 100mm, capacity about 18cc, with screw mount, without dovetailed slider	
HAPISELE	34016*	Pair of Plungers, 100mm long, 9mm diameter, with screw mount	
HAMYBARK	34018*	Pair of Cups, 50mm, capacity about 9cc, with screw mount, without dovetailed slider	
HAPOSYTO	34020*	Pair of Plungers, 50mm long, 9mm diameter, with screw mount	
HANETICO	34022*	Pair of Cups, capacity about 1cc, with screw mount, without dovetailed slider	
HAPUTYLA	34024*	Pair of Plungers, 50mm long, 4mm diameter, with screw mount	
HAHUTENE	**34026**	**Illuminating Attachment** (*described on page 224*), with dovetailed slider to attach to the stage of colorimeters Nos. 34000-34006	
HOLVO	**34028**	**Standard Colorimeter,** as described, with cups and plungers **20mm,** capacity of cups about 2cc, complete **with cabinet**	
HERXM	**34030**	**Standard Colorimeter,** same as No. 34028, but **without cabinet**	
		Supplementary Parts for Micro-Colorimetry *for Colorimeters Nos. 34028-34030*	
HALOMANE	**34032**	**Pair of Cups,** capacity about ½cc, with screw mount and dovetailed slider	$
HALINODE	**34034**	**Pair of Plungers,** 20mm long, 4mm diameter, with screw mount	
HALYELGE	**34036**	**Supplementary Parts for Micro-Colorimetry, complete** (Nos. 34032-34034)	
		Replacement Parts for Nos. 34028-34034:	
HAPYGOXA	34038*	Pair of Cups, 20mm, capacity about 2cc, with screw mount, without dovetailed slider	
HAROBOLA	34040*	Pair of Plungers, 20mm long, 9mm diameter, with screw mount	
HAREYOTA	34042*	Pair of Cups, capacity about ½cc, with screw mount, without dovetailed slider	
HARIZEBU	34044*	Pair of Plungers, 20mm long, 4mm diameter, with screw mount	
HAMAGINE	**34046**	**Illuminating Attachment** (*described on page 224*), with screw mounting to attach to the stage of colorimeters Nos. 34028-34030	
HAJEARES	**34048**	**Colorimeter Lamp,** with opal bulb, for direct connection to the light circuit, recommended for use with above colorimeters, utilizing the attachments Nos. 34026 and 34046, respectively	
OPAMU	**34050**	**Opal Lamp Bulb,** extra, for colorimeter lamp No. 34048	

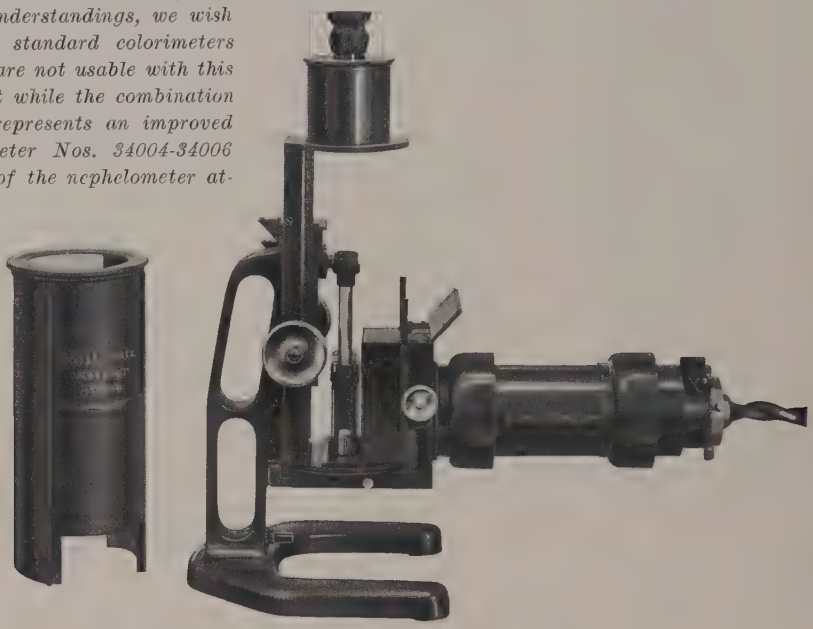
* *These accessories are included in the complete equipments; however, they are listed separately to order from in case of breakage.*

Note: For suitable colorimeter filters, refer to page 234.

COMBINATION COLORIMETER

with Nephelometer Attachment

The combination colorimeter represents in its general construction the standard colorimeter 50mm Nos. 34004-34006; however, provided for use in connection with it is offered a new model nephelometer attachment, No. 34116. (*To avoid misunderstandings, we wish to emphasize that the standard colorimeters listed on pages 223-225 are not usable with this nephelometer attachment while the combination colorimeter No. 34100 represents an improved construction of colorimeter Nos. 34004-34006 with provisions for use of the nephelometer attachment.*)



Combination Colorimeter No. 34100
with Nephelometer No. 34116 attached

Nephelometer Attachment—This device represents a most valuable accessory for colorimetric determinations. It attaches by a dove-tailed fitting to the under-surface of the stage plate of the combination colorimeter. The nephelometer consists of a rectangular housing provided with two openings for windows of rectangular size 25mm high, separated by a metal partition. Each opening may be closed independently of the other by a metal plate, adjustable in vertical direction by means of rack and pinion motion. The height of the opening (25mm) which is likewise the adjustable height of the effective depth of the liquid from which the *"Tyndall"* light is emitted, may be read off in a rectangular mirror reflecting scales and verniers.

Test tubes of 15mm inside diameter and 60mm in length are provided and these are held in position by spring sleeves. The test tubes are made to take the place of the colorimeter cups. A pair of glass rods attached to one holder are made to dip into the two vessels (test tubes) containing the standard and the unknown solutions. These rods do not serve so much to establish equality in depth of the layer of the solution on the right and left as to remove any error which would arise from the observation of the fluid meniscus and to serve as a means of viewing the central portion of the vessel. As this pair of plungers can be displaced vertically, nephelometric measurements can be made with very small quantities of fluid by lowering the pair of plungers without necessitating the use of special micro cells.

Whereas colorimetric measurements can be made in daylight (artificial light being preferred, however), the nephelometer always requires artificial light. The source of light employed with the nephelometer attachment is in all cases, the special lamp No. 34124, having a 6-volt, 5-ampere bulb (*listed on page 225*). The illuminating lens required for use with the nephelometer attachment in connection with the special lamp No. 34124 is mounted within the nephelometer housing. In order to render the light approximately similar to natural daylight, the apparatus is supplied with a daylight filter which is inserted on top of the ocular.

Note: The combination colorimeter does not originally have to be ordered with the nephelometer attachment; the latter can be added at any future time since the fittings are readily interchangeable with each other.

(*Continued on page 227*)

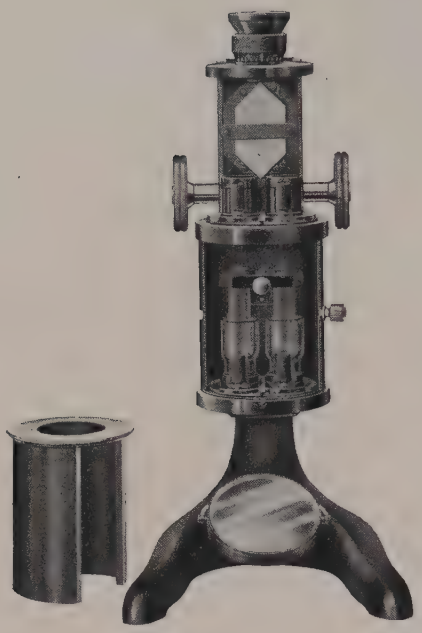
COMBINATION COLORIMETER with Nephelometer Attachment—(Continued)

Code Word	Cat. No.	Designation	Price
HERVK	**34100**	**Combination Colorimeter,** as described, with cups and plungers 50mm, capacity of cups about 9cc, complete **with cabinet** (*nephelometer attachment not being included*)	$
		Supplementary Parts for Micro-Colorimetry *for Colorimeter No. 34100*	
HAFOGENO	**34102**	**Pair of Cups,** capacity about 1cc, with screw mount and dovetailed slider	$
HAFUTEST	**34104**	**Pair of Plungers,** 50mm long, 4mm diameter with screw mount and dovetailed fitting	
HAFYSTRE	**34106**	**Supplementary Parts for Micro-Colorimetry, complete** (Nos. 34102-34104)	
		Replacement Parts for Nos. 34100-34104:	
HAMYBARK	34108*	Pair of Cups, 50mm, capacity about 9cc, with screw mount, without dovetailed slider	
HANATESE	34110*	Pair of Plungers, 50mm long, 9mm diameter, with screw mount, without dovetailed slider	
HANETICO	34112*	Pair of Cups, capacity about 1cc, with screw mount, without dovetailed slider	
HANIGETO	34114*	Pair of Plungers, 50mm long, 4mm diameter, with screw mount, without dovetailed slider	
		Supplementary Parts for Nephelometry:	
HAHEFOND	**34116**	**Nephelometer Attachment,** as described, with illuminating lens; the attachment is arranged to be mounted to the stage of the combination colorimeter by means of a dovetailed fitting with screw; furnished with two windows the aperture of which can be varied by metal sliders and rack and pinion movements, the adjusted opening is to be read off at a scale within an accuracy of 0.1mm, a mirror mounted opposite the scales and verniers facilitates reading; complete, but **without lamp** (described on pages 226, 231 and 232)	$
HAHIEREZ	**34118**	**Pair of Special Cups** (test tubes), capacity about 6cc, in spring sleeve on slider	
HAGUTIEF	**34120**	**Pair of Plungers,** 50mm long, 9mm diameter, with simultaneous holder for both, on dovetailed slider	
HAHOPLAN	**34122**	**Supplementary Parts for Nephelometry, complete** (Nos. 34116-34120)	
		Replacement Parts for Nos. 34118-34120:	
HAPAMERK	34128*	Pair of Special Cups (test tubes), capacity about 6cc, without metal sleeves and without dovetailed slider	
HANYGURI	34130*	Pair of Plungers, 50mm long, 9mm diameter, with screw mount, without dovetailed slider	
HAJAPACE	**34124**	**Special Colorimeter- and Nephelometer-Lamp,** with lamp bulb 6-volt, 5-ampere, in centering socket (*as described on page 225*), complete with cord and plug	
LINID	**32875**	**Lamp Bulb,** 6-volt, 5-ampere, for No. 34124, extra	
		Note: *Lamp No. 34124 is to be used with rheostat or transformer and dependent upon the current conditions make selection from those items listed on page 234.*	
HAHUTENE	**34026**	**Illuminating Attachment** (*described on page 224*), with dovetailed slider to attach to the stage of colorimeter No. 34100 ... (**In order to use lamp No. 34124 for colorimetric determinations, the illuminating attachment No. 34026 is required.**)	

* *These accessories are included in the complete equipments; however, they are listed separately to order from in case of breakage.*

Note: For suitable colorimeter filters, refer to page 234.

COMPENSATION COLORIMETER
and Hemoglobinometer involving the "Buerker" Principle



This special colorimeter follows in general a similar construction as is involved with the colorimeters previously listed. The apparatus represents a dipping colorimeter of a special design in which **complete optical symmetry is assured** by equalizing all refracting and reflecting surfaces as well as the liquid column on the right and left and again establishing their identity on both sides when measuring the color concentration. **This arrangement has the advantage that it practically eliminates the effect of the solvent.** The concentration of the solution to be tested and that of the standard are inversely related like the depth of the liquid which establishes the identity of the color. **This colorimeter provides a means to eliminate by a method of compensation, the influence of any other colored substance which may be present and which otherwise is likely to interfere with the correct reading.**

As may be learned from the accompanying diagram, the rays furnished by a uniform source of light are reflected at the plano mirror "S" or a white opal glass plate mounted to adjustable arm and the rays are then transmitted through the openings in the stage. In this manner, the light rays are divided into right and left pencils separated by a distance of 10mm. Maintaining this distance, the two pencils traverse successively two identical cups "Br" and "Bl," two plungers "Str" and "Stl," two glass cells "Vr" and "Vl," the latter of an effective depth for the liquid of 10mm, and finally they traverse the *"Huefner"* prism "A." The two pencils of rays are united within this prism in such a manner that they appear within the field of vision as if separated into two semi-circles by a fine hair-line. The ocular is provided with a micrometer focusing device for accurate adjustment upon the dividing line.

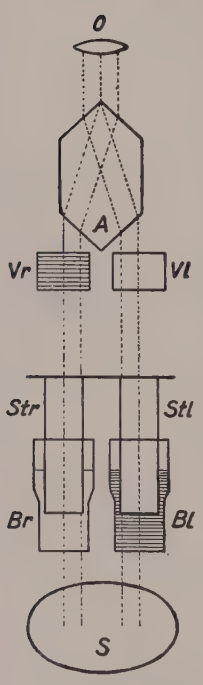


Diagram of the "Buerker" system

The one semi-circle which presents itself to the eye as the right field will be completely filled with light by the left pencil and vice versa. The two semi-circles represent a large field and because the line of separation is exceedingly fine, it follows that an easy means of comparing the two halves is facilitated.

The two cups "Br" and "Bl" as well as the two glass cells "Vr" and "Vl," the latter of an effective liquid column of 10mm, are mounted to movable dovetailed sliders. When inserted up to their limit stop, the vessels occupy their correct positions above the centers of the respective openings. The cups as well as the glass vessels are mutually interchangeable for the purpose of testing the optical symmetry of the apparatus. The plungers "Str" and "Stl" situated between the cups and vessels are jointly supported by one bracket attached by two pins and a screw to a rack and pinion movement, controlled by knurled heads and by means of these, the plungers may be raised and lowered so as to establish the appropriate but always mutually equal depth of liquid. After the release of the screw, the bracket fitting together with the plungers may be detached and removed from the colorimeter and in a similar manner again be replaced.

A sliding door serves to shield the cups and plungers against external light and protects them against injury. The vessels "Vr" and "Vl" as well as the *"Huefner"* prism become accessible after removing the upper metal sleeve of the housing. A scale with vernier above the pinion head at the right-hand side provides means of accurate readings within 0.1mm the thickness of the liquid layer established by means of the plungers immersed into the cups. The reading may be sensitized to 0.05 or 1/20mm by the following method: In the event of a vernier line coinciding with a line on the principal scale, the resulting reading should be multiplied by two which will give the even twentieths. The odd twentieths will be found from that portion of the scale where two vernier scale lines are situated symmetrically between two lines of the principal scale. The correct adjustment of the apparatus may be verified by removing the vessels "Vr" and "Vl," introducing the solvent into the right cup and the colored solution into the left cup and then completely immersing the plungers down to the bottom. The color in the right field should then completely disappear and the zero line of the vernier should coincide with the zero line of the principal scale.

COMPENSATION COLORIMETER—(Continued)

This special colorimeter is available for the following methods of application:

A: Standard colorimetric determinations involving the *"Buerker"* compensation principle;

B: Micro-colorimetry involving the *"Buerker"* compensation principle;

C: Special method for hemoglobin determination involving the *"Buerker"* compensation principle;

D: Special method for the determination of the plasmae in serum involving the *"Buerker"* compensation principle;

E: Special method for determining bromine in serum, cerebro spinal fluid and other fluids of the body, involving the *"Buerker"* compensation principle.

Note: Inasmuch as we have published an elaborate pamphlet dealing with all the available methods of application of this colorimeter, giving explicit directions for its use, we refrain from describing it more extensively in this catalog; but to those interested, we suggest to write for pamphlet No. E-2336.

Code Word	Cat. No.	Designation	Price
HEGLO	**34150**	**Compensation Colorimeter after** *"Buerker,"* as described, with two cups, two plungers, two vessels for compensation fluid, and two mixing flasks with stoppers, complete, **in cabinet**	$
BURCF	**34152**	**Vertical Top Reading Attachment,** permitting to read the vernier from the same position the head maintains during observation	
		Supplementary Parts for Hemoglobin Determination:	
HEPIP	**34154**	**Pipette,** calibrated to hold 2,475cmm, with rubber tubing and mouthpiece	$
HEOXE	**34156**	**Pipette,** calibrated to hold 25cmm, with rubber tubing and mouthpiece	
HENAD	**34158**	**Blood Lancet,** *"Francke"*	
HEMGU	**34160**	**Glass Rod,** for mixing the blood solution and sodium hydro-sulphite	
HEKAS	**34162**	**Spoon,** small, for taking and transferring the hydro-sulphite	
HADALIES	**34164**	**Vessel,** for 10mm layer of liquid for standard solution (reduced hemoglobin), with calibration chart	
HADEAGEL	**34166**	**Vessel,** for 10mm layer of liquid for the solvent (0.1% soda solution)	
HADISTOK	**34168**	**Bottle,** of pure anhydrous soda	
HADOTANG	**34170**	**Bottle,** of reducing reagent (sodium hydro-sulphite)	
HETUI	**34172**	**Case,** for the accommodation of the accessories listed under Nos. 34154-34170	
HEZUB	**34174**	**Supplementary Parts for Hemoglobin Determination, complete** (Nos. 34154-34172)	
HARDUMIG	**34178**	**Micro Equipment for Compensation Colorimeter No. 34150,** consisting of two especially thin plungers, two especially small cups for the test solution, **for making determinations on small quantities, according to the method of** *Fr. K. Walter*	
		Replacement Parts for Nos. 34150 and 34178:	
HETRY	34180*	Cup, 30mm high, with screw mount, with dovetailed slider	ea.
HETCA	34182*	Cup, 30mm high, with screw mount, without dovetailed slider	ea.
HEVTI	34184*	Vessel, 10mm high, with screw mount, with dovetailed slider	ea.
HEVBO	34186*	Vessel, 10mm high, with screw mount, without dovetailed slider	ea.
BURDO	34188*	Plunger, 35mm high, with screw mount	ea.

* *These accessories are included in the complete equipments; however, they are listed separately to order from in case of breakage.*

Note: For suitable colorimeter filters, refer to page 234.

UNIVERSAL COLORIMETER

The universal colorimeter represents an **instrument entirely novel in its design** and is destined to meet the long-felt desire for a colorimeter **constructed to serve the most exacting requirements in research colorimetry.** As the word "universal" implies, this new colorimeter has been so arranged that it affords a ready interchange of all available colorimetric appliances so as to have one instrument available for every conceivable colorimeter method so far known. Because every part is replaceable against each other and the unit fittings are pre-centered, it is not at all necessary that from the beginning the universal colorimeter be ordered inclusive of all the implements required for the various colorimeter methods; it fully suffices to order the colorimeter stand proper with the one or other accessory for specific determinations and at will additional accessories can then later be added from time to time.

The new universal colorimeter resembles in its external design and appearance, the standard colorimeter 50mm (*listed on pages 224-225*). The stage plate accommodates on dove-tailed sliders, inserted from the side, the cups for the respective solutions. The fittings for the cups of the various different methods are precisely centered and align themselves to the optical axis with minute accuracy. The cups offered for the variety of colorimeter methods are interchangeable against each other, thereby eliminating errors by repeating a test with cups transferred to alternate sides.

The plungers are vertically displaced by means of rack and pinion motion. These plungers are attached to a dove-tailed slide fitting and may be removed without difficulty for the purpose of cleaning. The rear of the colorimeter stand is provided with millimeter scales and verniers by means of which the depth of the liquid layer may be read accurately within 0.1mm. The process of reading the scale is greatly facilitated by a prism attached opposite the verniers.

The cups and plungers are surrounded by a light-proof housing so as to eliminate external light and to protect the optical parts against injury. When using the apparatus as nephelometer, the lower portion of the cylindrical housing requires to be moved upward (*see figure 4 on page 231*) to provide the proper opening. The *"Huefner"* prism is likewise surrounded by a cylindrical housing easily removable for cleaning the prism. The only portion that protrudes from the light-proof housing is the observation ocular equipped with a micrometer movement for accurate focus upon the separation line within the field of view.

A: Universal Colorimeter Used As Standard Colorimeter:
(*See Fig. 1*)

By attaching to the colorimeter stand the proper cups and plungers (50 or 20mm), the universal colorimeter is readily transferred into an instrument for standard colorimetric determinations according to the *"Duboscq"* method. The size of the colorimeter stand being such that as largest cups those of 50mm high are applicable, it is naturally understood that cups of 100mm height are not adaptable.

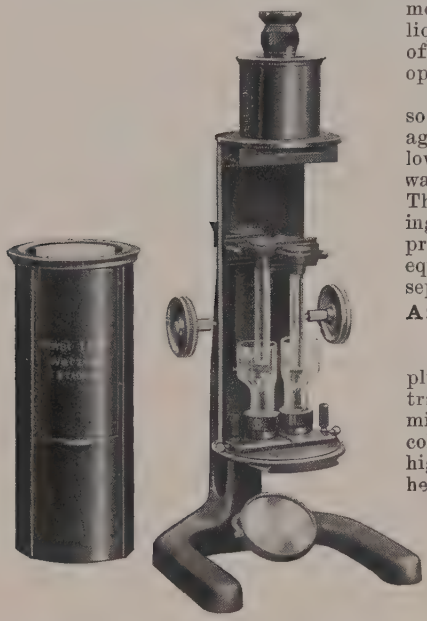


Fig. 1
Universal Colorimeter arranged for standard determinations according to the *"Duboscq"* method

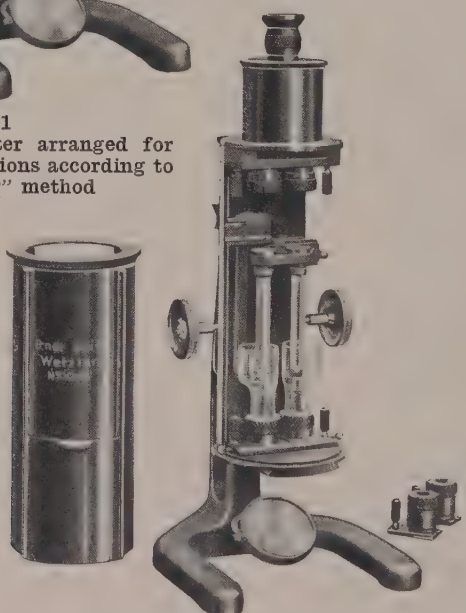


Fig. 2
Universal Colorimeter arranged for *"Buerker"* compensation method

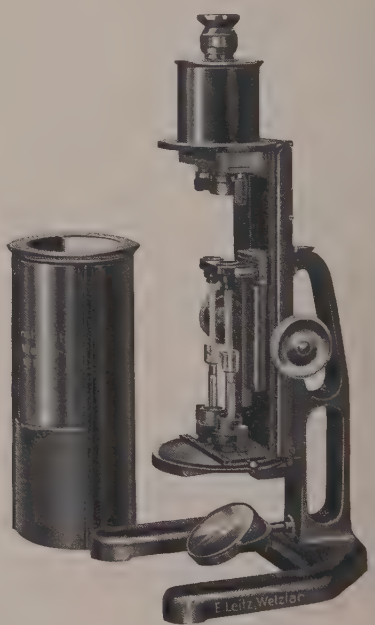


Fig. 3
Universal Colorimeter arranged for *"Buerker"* compensation method
(*utilizing the accessories for micro-colorimetry*)

(*Continued on page 231*)

UNIVERSAL COLORIMETER—(Continued)

B: Universal Colorimeter Used As Colorimeter Involving the *"Buerker"* Compensation Method:
(See Figs. 2 and 3)

Aside from the colorimeter being available for the *"Duboscq"* method as explained under chapter "A," it is likewise transposable for use involving the *"Buerker"* compensation principle. As illustrated in Fig. 2 and 3, the colorimeter stand has fitted to it immediately under the prism, two receptacles holding compensation vessels for permanent color solutions according to the method as suggested by Prof. Buerker. These vessels are supplied calibrated to hold a layer of liquid 10 or 20mm deep respectively, and permit of being hermetically sealed when filled with the standard or compensating solution; viz., the solvent of the standard solution employed. In the *"Buerker"* arrangement, the place of the independently movable plungers is taken by a pair of identical plungers attached to one simultaneous holder made to dip jointly into the cups. This method establishes perfect optical symmetry for all refracting and reflecting surfaces and all depths of liquid are identical, similar on the right and left sides of the colorimeter.

By the *"Buerker"* method, **the influence of the solvent is eliminated** and a further means is thereby obtained for eradicating the effect of some other colored substances which otherwise may interfere with the accuracy of the colorimetric determination.

Note: In pamphlet No. E-2336, the especially devised colorimeter after the *"Buerker"* method is described completely and directions are given therein; if one is desirous of fully familiarizing himself with the data offered on this subject, we suggest writing for the pamphlet mentioned.

C: Universal Colorimeter Used As Colorimeter Involving the *"Ellinger"* Method:

The appliances used for the *"Ellinger"* method closely resemble those involved when the colorimeter is equipped for investigations according to the *"Buerker"* principle, except that while in the latter the standard vessels are closed, in the *"Ellinger"* method these vessels are open and of a capacity of 4ccm. In this arrangement, the cups are mounted to dovetailed sliders immediately beneath the prism.

The colorimeter stand proper is supplied with an additional set of rack and pinions for the vertical displacement of one pair of plungers which are made to immerse into the compensation vessels. By this method the layer of the compensation fluid can be varied at will. The set of plungers and compensation vessels are mounted immediately below the prism housing, superimposing the standard set of plungers and cups. ***(Due to the fact that illustrations and electrotypes were not available at the time this catalog went to press, the feature pertaining to the additional set of rack and pinions and plungers, respectively is not embodied in the illustrations shown in Figs. 1, 2, 3 and 4 on pages 230 and 231.)***

D: Universal Colorimeter Used As Micro-Colorimeter:

Further means of extending the potentialities of the universal colorimeter are offered in equipping it with micro-colorimetric attachments, involving, however, the *"Duboscq"* principle. Micro-colorimetric determinations are particularly desirable when only exceedingly minute quantities of substances (blood and other fluids of the body) are available. To carry out these micro measurements, the colorimeter is equipped with cups and plungers of small dimensions.

E: Universal Colorimeter Used As Nephelometer:
(See Figs. 4 and 5)

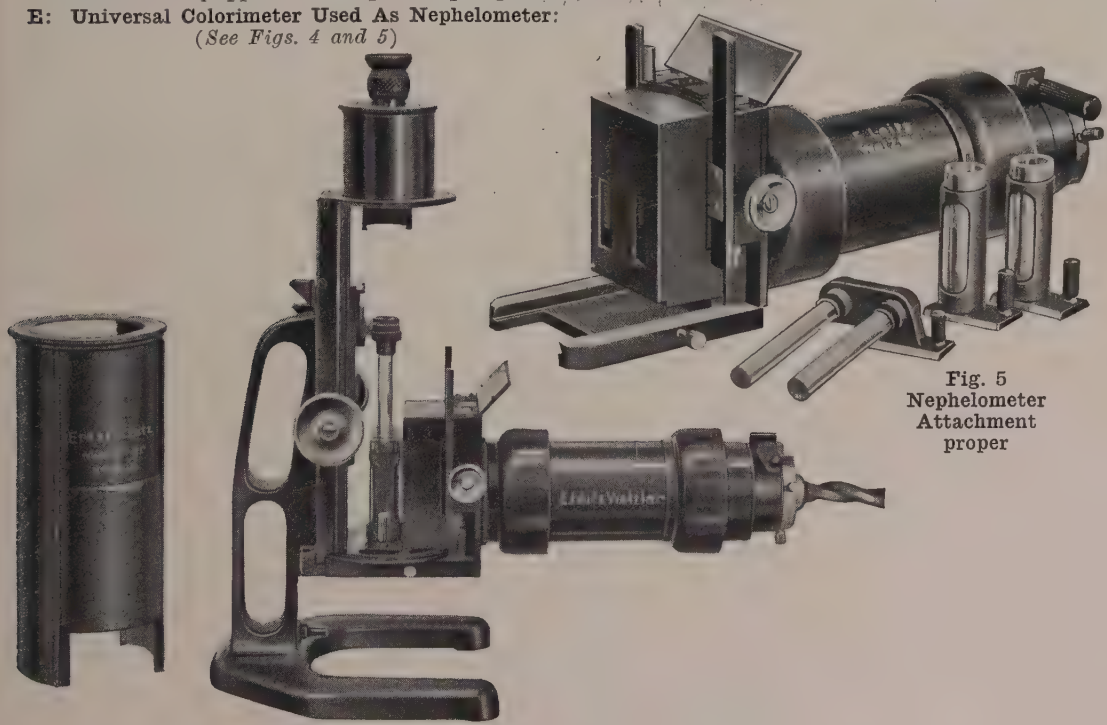


Fig. 4
Universal Colorimeter with Nephelometer attached

Fig. 5
Nephelometer Attachment proper

(Continued on page 232)

UNIVERSAL COLORIMETER—(Continued)

E: Universal Colorimeter Used as Nephelometer:
(*See Figs. 4 and 5, page 231*)

The nephelometer method is closely allied in its practical application to colorimetric determinations. It differs however from the colorimetric method in that instead of light transmitted from the clear solution being measured, the cloudy solution is viewed at right angles to the illumination so that the light which is diffracted by the individual particles (so-called *"Tyndall"* light) is measured. The depth of the layer of fluid which participates in the emission to the *"Tyndall"* light (the intensity of which is proportional to this depth) when set to identity of intensity by varying the window opening with the aid of the rack and pinion motion, may be accurately read off to 0.1mm on a scale with the aid of a vernier, as is the case with colorimeters. In accordance with Beer's Law which likewise holds good for the nephelometer, the concentration of the unknown (cloudy) solution is then calculated from the height of the window openings, measured in millimeters, and the concentration of the standard solution. The following point should be noted when operating the nephelometer: While the comparison is being made, the solutions may not undergo any changes such as are likely to be occasioned by the removal of flocculent matter; i.e., the degree of clouding should remain constant. The turbidity should be perfectly homogeneous and solely due to particles of uniform size. Like the colorimetric method, nephelometric determinations demand that the ratio of degrees of concentration under comparison should not exceed 1:2 or 1:3 wherever practicable. The exactness of the reading increases as the concentrations approach the condition of similarity.

The nephelometer attachment offered for the universal colorimeter consists of a light-proof housing to exclude external light. This housing attaches by means of a dove-tailed groove to a dove-tailed slider situated at the under-surface of the colorimeter stage plate. The housing is provided with two rectangular openings (windows) 25mm high which are separated by a partition. Either opening may be closed independently of the other by a metal plate vertically displaced by means of a rack and pinion motion. The height of the opening which is likewise the height of the effective depth of the fluid from which the *"Tyndall"* light is emitted may be read off in a rectangular mirror in which reflect the millimeter scales and verniers. Test tubes of 15mm inside diameter and 60mm long, held in position by spring sleeves, take the place of the cups. A pair of glass rods (as in the *"Buerker"* device) attached to one simultaneous bracket, are made to dip into the two vessels (test tubes) containing the standard and the unknown solutions. They serve not so much to establish an equal depth of the layer of fluid on the right and left, as to remove any error which would arise from the observation of the fluid meniscus and to provide a means of viewing the central portion of the vessel. As this pair of plungers can be vertically displaced, nephelometric measurements can be made with very small quantities of fluid by lowering the pair of plungers without necessitating the use of special micro cells. Whereas colorimetric measurements can be made in daylight, nephelometry always requires artificial light. The source of light employed with the nephelometric attachment offered for the universal colorimeter is in all cases the special Leitz low-voltage lamp 6-volt, 5-ampere, as shown in Figs. 4 and 5, being attached to the nephelometer housing. The illuminating lens required is mounted within the wall of the nephelometer housing. In order to render the light approximately similar to natural daylight, the apparatus is supplied with a daylight filter attachable to the ocular. (*For full description of the special nephelometer lamp, see page 225.*)

Code Word	Cat. No.	Designation	Price
HAFALIOR	**34200**	**Universal Colorimeter—Stand only**—without cups, vessels or plungers, with stage plate provided at the upper surface with two dovetailed grooves for cups, recess for the insertion of filters at the lower surface equipped with a dovetailed slider for the attachment of nephelometer and illuminating devices respectively; rack and pinion motion for the displacement of the plungers, additional rack and pinion for the displacement of the plungers immersing into the compensation cups according to the *"Ellinger"* method; millimeter scales with verniers and top reading prisms; dovetailed grooves for the reception of standard vessels according to the *"Buerker"* method; *"Huefner"* comparison prism; observation ocular; mirror with reflecting and ground glass surfaces; housing for screening the optical parts; complete, **in case**	$
		1. Accessories for the *"Duboscq"* Method:	
		1-A. for General Colorimetric Measurements:	
HAFESINO	**34202**	**Pair of Cups,** about 9cc capacity, with screw mount, with dovetailed slider	$
HAFIPAAR	**34204**	**Pair of Plungers,** 50mm high, 9mm diameter, with screw mount and dovetailed slider	
HERHC	**34206**	**Accessories 1-A complete** (Nos. 34202-34204)	
		1-B. for Micro-Colorimetric Measurements:	
HAFOGENO	**34208**	**Pair of Cups,** about 1cc capacity, with screw mount and dovetailed slider	
HAFUTEST	**34210**	**Pair of Plungers,** 50mm high, 4mm diameter, with screw mount and dovetailed slider	
HERMT	**34212**	**Accessories 1-B complete** (Nos. 34208-34210)	

(*Continued on page 233*)

UNIVERSAL COLORIMETER—(Continued)

Code Word	Cat. No.	Designation	Price
		Replacement Parts for Accessories 1-A and 1-B:	$
HAMYBARK	34214	Pair of Cups, about 9cc capacity, with screw mount, without dovetailed slider	
HANATESE	34216	Pair of Plungers, 50mm high, 9mm diameter, with screw mount, without dovetailed slider	
HANETICO	34218	Pair of Cups, about 1cc capacity, with screw mount, without dovetailed slider	
HANIGETO	34220	Pair of Plungers, 50mm high, 4mm diameter, with screw mount, without dovetailed slider	
		2. Accessories for the *"Buerker"* Method:	
		2-A. for General Colorimetric Measurements:	
HAFESINO	**34202**	**Pair of Cups,** about 9cc capacity, with screw mount and dovetailed slider	$
HAGAZUDO	**34222**	**Pair of Standard Vessels,** for liquid column 10mm high, with screw mount and dovetailed slider	
HAGEZASE	**34224**	**Pair of Standard Vessels,** for liquid column 20mm high, with screw mount and dovetailed slider	
HAGUTIEF	**34226**	**Pair of Plungers,** 50mm high, 9mm diameter, with one simultaneous bracket for both plungers, with dovetailed slider	
HERKV	**34228**	**Accessories 2-A complete** (Nos. 34202 and 34222-34226)	
		Note: *If the accessories for the "Duboscq" method listed under 1-A have been ordered, which include one pair of cups No. 34202, it will not be essential to order the additional pair listed under 2-A.*	
		2-B. for Hemoglobin Analysis:	
HAGITURA	**34230**	**Standard Vessel,** for liquid column 10mm high, containing the *"Buerker"* hemoglobin solution, with screw mount and dovetailed slider	
HAGOFORM	**34231**	**Standard Vessel,** for liquid column 10mm high, containing 0.1% soda solution, with screw mount and dovetailed slider	
HERNR	**34232**	**Accessories 2-B complete** (Nos. 34230-34231)	
		2-C. for Micro-Colorimetric Measurements:	
HAFOGENO	**34208**	**Pair of Cups,** about 1cc capacity, with screw mount and dove-tailed slider	
HAFUTEST	**34210**	**Pair of Plungers,** 50mm high, 4mm diameter, with one simultaneous bracket for both plungers, with dovetailed slider	
HERWG	**34236**	**Accessories 2-C complete** (Nos. 34208-34210)	
		Note: *If the accessories for the micro-colorimetric measurements listed under 1-B are ordered, which include one pair of cups No. 34208 and one pair of plungers No. 34210, it will not be essential to order the additional pairs listed under 2-C.*	
		Replacement Parts for Accessories 2-A and 2-B:	
HANOGAMO	34237	Cylindrical Glass Body, with glass bottom plate of standard vessel, for liquid column 10mm high, without mount and without dovetailed slider ea.	
HANUGOSE	34238	Cylindrical Glass Body, with glass bottom plate of standard vessel, for liquid column 20mm high, without mount and without dovetailed slider ea.	
HANYGURI	34239	Pair of Plungers, 50mm high, 9mm diameter, with screw mount, without dovetailed slider	
		3. Accessories for the *"Ellinger"* Method:	
HERZX	**34246**	**Pair of Standard Vessels,** with open top, about 4ccm capacity, with screw mount and dovetailed slider	
HOSAT	**34248**	**Pair of Plungers,** 30mm high, 9mm diameter, with one simultaneous bracket for both plungers, with dovetailed slider	
HOSBA	**34250**	**Accessories 3 complete** (Nos. 34246-34248)	

(Continued on page 234)

UNIVERSAL COLORIMETER—(Continued)

Code Word	Cat. No.	Designation	Price
		Replacement Parts for Accessories 3:	$
HOSCE	34252	Pair of Standard Vessels, about 4ccm capacity, with screw mount, without dovetailed slider	
HOSDO	34254	Pair of Plungers, 30mm high, 9mm diameter, with screw mount, without bracket or dovetailed slider	
		4. Accessories for the Nephelometer Method:	
HAHEFOND	**34116**	**Nephelometer Attachment,** as described, with illuminating lens; the attachment is arranged to be mounted to the stage of the universal colorimeter by means of a dovetailed fitting with screws; furnished with two windows, the aperture of which can be varied by metal sliders and rack and pinion movements, the adjusted opening is to be read off at a scale within an accuracy of 0.1mm, a mirror mounted opposite the scales and verniers facilitates reading; complete, but **without lamp**	$
HAHIEREZ	**34118**	**Pair of Special Cups** (test tubes), capacity about 6cc, in spring sleeve, with slider	
HAGUTIEF	**34120**	**Pair of Plungers,** 50mm long, 9mm diameter, with simultaneous holder for both, on dovetailed slider	
HAHOPLAN	**34122**	**Accessories 4 complete** (Nos. 34116-34120)	
		Replacement Parts for Accessories 4:	
HAPAMERK	34128	Pair of Special Cups (test tubes), capacity about 6cc, without metal sleeves and without dovetailed slider	
HANYGURI	34130	Pair of Plungers, 50mm long, 9mm diameter, with screw mount, without dovetailed slider	
		5. General Accessories:	
HAHUTENE	**34026**	**Illuminating Attachment** (*as described on page 224*), with dovetailed slider to attach to stage of universal colorimeter No. 34200	
HAJAPACE	**34124**	**Special Colorimeter- and Nephelometer-Lamp,** with lamp bulb 6-volt, 5-ampere, in centering socket (*as described on page 225*), complete with cord and plug	
LINID	**32875**	**Lamp Bulb,** 6-volt, 5-ampere, for No. 34124, extra **Note:** *For the reason that No. 34124 represents a low-voltage lamp, either a rheostat or transformer is required for its use dependent upon current conditions, and we list for selection:*	
REDIG	**32855**	**Rheostat,** stationary, for lamp on **110**-volt **D.C.**	$
REDUK	**32860**	**Rheostat,** stationary, for lamp on **220**-volt **D.C.**	
BYSFI	**32865**	**Transformer,** stationary, for lamp on **110**-volt **A.C.**	
BYSGO	**32870**	**Transformer,** stationary, for lamp on **220**-volt **A.C.**	
		Colorimeter Filters:	
HAMEATON	**34260**	**Daylight Filter,** in mounting, to attach to the ocular	
HAMIOGNE	**34262**	**Blue Filter,** in mounting, to drop into the bottom plate of the colorimeter	
HAMOBUND	**34264**	**Green Filter,** in mounting, to drop into the bottom plate of the colorimeter	
HAMUGERA	**34266**	**Red Filter,** in mounting, to drop into the bottom plate of the colorimeter	
HASELUTE	**34268**	**Yellow Filter,** in mounting, to drop into the bottom plate of the colorimeter	

BI-COLORIMETER

Three-Wedge Type

after Victor C. Myers

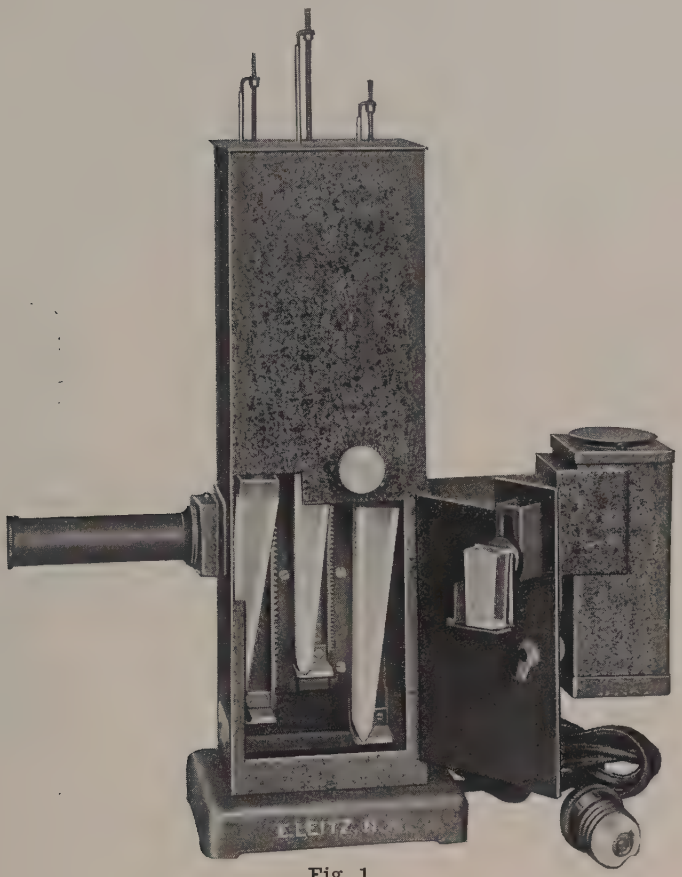


Fig. 1

This bi-colorimeter has been primarily constructed for the colorimetric determination of the hydrogen-ion concentration. As ordinarily carried out this determination is cumbersome and rather crude, since it has been necessary to employ a series of tubes with graduated pH values as standards, owing to the fact that here one is dealing with combinations of two colors instead of a single color.

Construction—The bi-colorimeter consists of a metal housing attached to a heavy cast-iron base. It measures 300mm in height and is provided with three rack and pinions for raising and lowering three wedges, the movement of these wedges taking place entirely within the closed housing. For each wedge a scale in adjustable mounting has been provided so that the scales can be set at zero point. The adjustment of the scales is accessible from the outside of the housing. The scales emerge from the top of the colorimeter housing as the wedges are raised.

The rays emanating from the "Known" and "Unknown" solutions are united into one simultaneous field by means of a *"Huefner"* prism similar to that employed in the colorimeters described on previous pages. With this prism the light passes through the center of the wedges and cup, furnishing an even field for comparison. An observation ocular renders a magnified field of large diameter.

To the back of the colorimeter housing is attached a lamp (See Fig. 1) and behind the lamp bulb is situated a reflector which concentrates the rays in a suitable manner which pass through a *"Daylite"* glass window to illuminate both the wedges and the cup with "Known" and "Unknown" solutions. The light obtained with the lamp compares favorably with daylight in quality, although somewhat greater in intensity.

A door at the right of the colorimeter housing permits access to the wedges for the "Known" and to the cup for the "Unknown," the latter being mounted to the door (See Fig. 1).

Directions for Use—The wedges employed are those made according to the *"Hellige"* design. Two wedges provide for bi-colorimetric work as in the pH determination. However, to obtain a perfect match with "Unknown" solutions which are slightly turbid or colored a third wedge is desirable. To obtain an even field it is sometimes necessary to counterbalance the greater thickness of glass on the wedge side of the field. Provision has been made for this by attaching to the rack carrying the cup for the "Unknown" a clip, which will hold one or more glass plates.

(Continued on page 236)

BI-COLORIMETER—(Continued)

The wedges are constructed with such an angle that, when a single wedge is used, the 100mm scale should read the strength of the "Unknown" in percentage; viz., with a reading of 37mm the "Unknown" should be 37%, the strength of the standard. Practically, it is very difficult to manufacture wedges which are exactly correct, and it is best to calibrate each wedge. However, both the wedges and the cup are provided with adjustments, the cup adjustment having a vernier scale. When the angle of the wedge is such as to require only slight correction, these two adjustments are sufficient to secure accurate percentage readings.

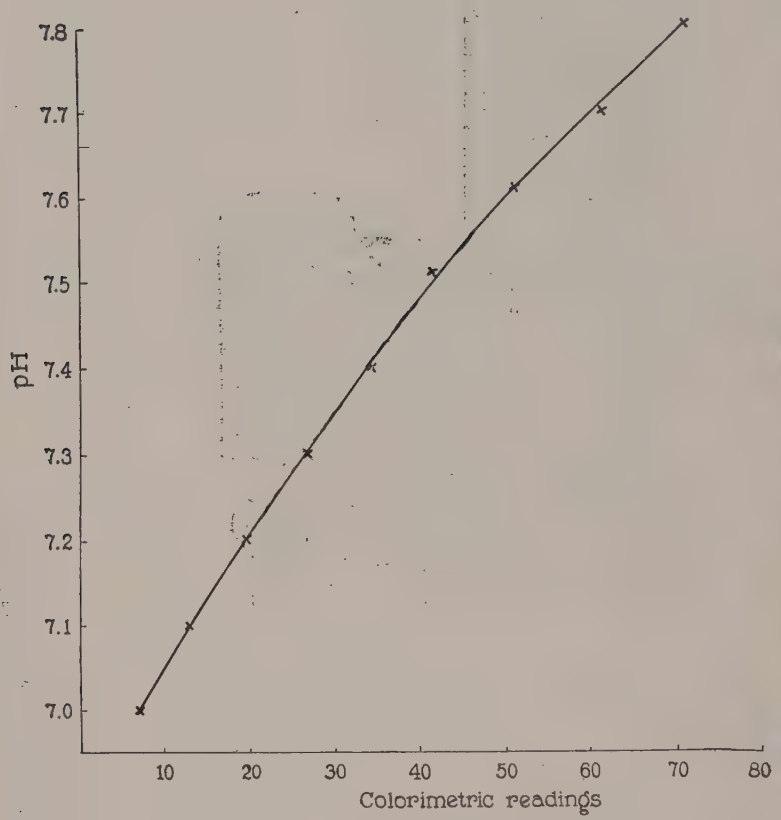


Fig. 2

Fig. 3

Colorimetric readings

Readings made with wedge containing dominant color
(alkaline, pH 8.0, phenol red solution)

Accuracy of Reading with the Bi-Colorimeter—The chart shown in Fig. 2 is presented to illustrate the reading accuracy of the instrument. Standards were prepared to cover the same range as that employed by Cullen[1] in his colorimetric pH determination in blood. The standard solutions for the two wedges were made with pH values of about 8.0 and 6.8. For the alkaline wedge 1.1cc of M/15 primary and 18.9cc of M/15 secondary phosphates (Merck's special reagent) were used. Two cc of 0.02% phenol red were added to both solutions. For the calibrations of the wedges, nine different standards were employed covering the pH range from 7.0 to 7.8, the standards differing by 0.1pH. Five cc portions were prepared in *"Pyrex"* test tubes from the M/15 phosphates, and 0.5cc of the phenol red solution was added to each. It will be noted that none of the readings fall more than one place away from the curve plotted; the value of one place on the scale being 0.012 pH. It is believed that under favorable conditions the reading accuracy of the instrument for the above range of pH should be well within +0.02.

[1] *Cullen, G. E., J. Biol. Chem., 1922, lii, 501.*

(*Continued on page 237*)

BI-COLORIMETER—(Continued)

Uses of the Bi-Colorimeter—This instrument is considered well suited for the colorimetric determinations of the hydrogen-ion concentration in various biological fluids such as urine, gastric contents, blood, bacteriological culture media, etc. This instrument also serves excellently for the *"Marriott"* alveolar carbon dioxide test. It is a matter of common observation that in the phenolsulphonephthalein renal function test it is rarely possible to obtain an exact color match, probably because certain salts present in the urine prevent a complete change in the color of the indicator on the addition of alkali. By using an acid (yellow) 'phthalein standard it is always possible to obtain an exact color match. If desired, correction may be made for the rather small error introduced by the "off" color. For the *"Marriott"* alveolar carbon dioxide test and the *"Rowntree-Geraghty"* 'phthalein test, the colorimeter described will prove to be of material assistance in obtaining correct results while for the most exact bi-colorimetric hydrogen-ion concentration work, its use is most important inasmuch as it replaces the many inadequate methods heretofore used, and offers readings of utmost accuracy.

Summary—The Bi-Colorimeter has been designed chiefly for such bi-colorimetric work as the colorimetric pH determinations. The standards are carried in wedges, one, two or three of which may be employed at the same time. With one wedge the instrument may be used as an ordinary colorimeter. The second wedge provides for bi-colorimetric work. To obtain a perfect match with "Unknown" solutions which are slightly turbid or colored a third wedge is recommended.

Bibliography:

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"Preliminary report made to the American Society of Biological Chemists at the New Haven meeting," December, 1921, Myers, V. C., J. Biol. Chem., 1922, xxii.

Myers, V. C., Proc. Soc. Exp. Biol. and Med., 1921-22, xix, 78.

Barnett, G. D., and Barnett, C. W., Proc. Soc. Exp. Biol. and Med., 1920-21, xviii, 127.

Gillespie, L. J., J. Bact., 1921, vi, 399.

Code Word	Cat. No.	Designation	Price
METUX	**34300**	**Bi-Colorimeter** after *Victor C. Myers*, three-wedge type, with three empty glass wedges and one glass trough, lamp housing with lamp, cord and plug, complete, **in wooden cabinet**	$
MEYAG	**34302**	**Bi-Colorimeter,** same as No. 34300, but **without wooden cabinet**	
MEYBU	**34304**	**Wedge, empty,** with ground-in glass stopper	
MEYCY	**34306**	**Trough (Cup),** without stopper	
MEYDZ	**34308**	**Trough (Cup),** with ground-in glass stopper	
MEYFO	**34312**	**Case** for **one** wedge	
MEYGR	**34314**	**Case** for **three** wedges	
MEYHS	**34316**	**Case** for **six** wedges	
DABST	**3855**	**Lamp Bulb,** 15-watt, 110-volt, for lamp housing of bi-colorimeter No. 34300, extra	
MEYIT	**3846**	*"Daylite"* **Filter** for lamp housing of bi-colorimeter No. 34300, extra	
DABRX	**3850**	**Rheostat,** for use with 15-watt, 110-volt lamp of bi-colorimeter No. 34300, on **220-volt** circuit	

R-POLARIMETER

with Stationary Analyzer

(Pocket Model)

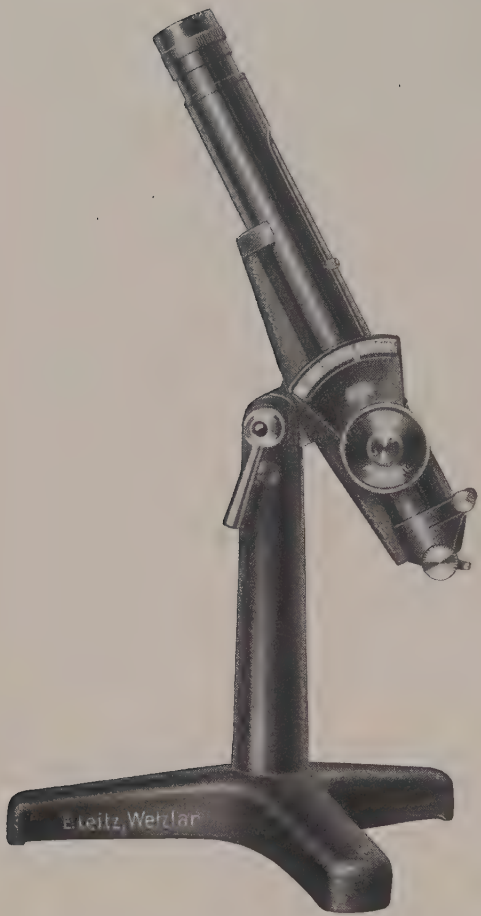


Fig. 1
Polarimeter Model "B" No. 34354 attached to laboratory stand No. 34358

Fig. 2
Polarimeter Model "B" No. 34354 attached to folding stand No. 34360

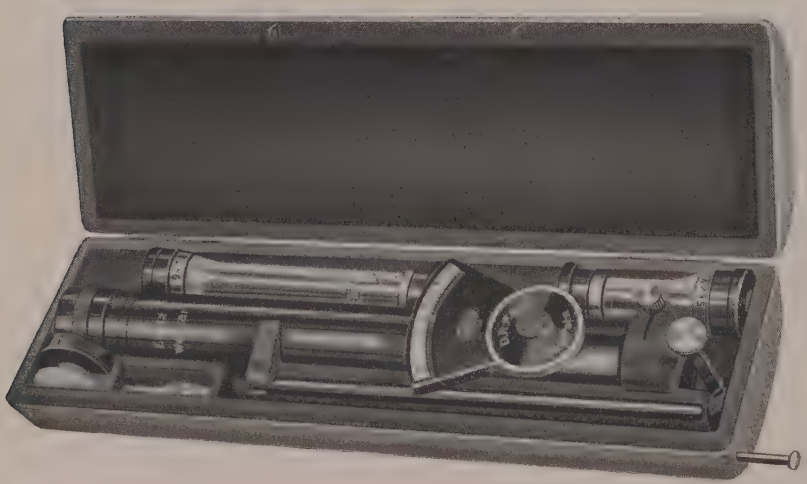


Fig. 3
Polarimeter Model "B" No. 34356 folded in pocket case

- No setting to "zero" required
- Large scale readings
- Higher degree of exactness with tubes of short lengths
- Using half-standard and quarter-standard tubes
- Daylight illumination

(Continued on page 239)

R-POLARIMETER—(Continued)

—Pocket Model—

The new Leitz pocket R-polarimeter serves for the quantitative analysis of grape sugar in urine and is primarily designed for the use of medical practitioners and for medical laboratory work. It is accordingly made in the form of a dextro-rotary polarimeter only since the extremely small quantities of laevo-rotary albumen which occur in the urine are not amenable to estimation with the polarimeter, while other laevo-rotary substances do not occur in urine. (*Differential measurements before and after the elimination of the albumen furnish inaccurate readings in most cases; it is, therefore, better that in these cases, other methods be employed such as color reactions with the aid of colorimeters.*)

The main object of the design of the new Leitz polarimeter was to produce for the use of the medical practitioner and any medical laboratories, an instrument which while exceedingly simple to manipulate, should furnish a means of rapidly determining the amount of sugar present. This has been achieved by abandoning the principle of the *"Laurent"* half-shadow and adopting in its place an optical arrangement, the distinctive feature of which is the stationary position of the analyzer. This device does away with the necessity of setting the instrument to its zero point which is both laborious and a well-known source of more or less pronounced errors. A further advantage is the new compensator, the rotation of which furnishes the reading on the scale of the percentage of sugar present. A notable feature of this compensator is that even at low percentages, large scale readings result so that a concentration of 5% of sugar examined in a ½ standard tube (model "B") gives a scale reading of nearly 45° whereas other instruments for the same tube length and a like sugar solution give a scale reading of only 2.5°. Due to this fact, it has not only become practicable to dispense with vernier and magnifier readings, but in addition, the instrument is more readily set for taking a reading. The scale of the compensator furnishes a direct reading of the sugar contents in terms of percentages.

The light filter mounted within the instrument renders it available for use in daylight as well as artificial light. When using artificial light it may sometimes be necessary to insert the small ground glass disc supplied with the instrument. To render it easier to work with the polarimeter, it may be set up on a stand. We supply for this purpose, a simple folding stand (see Fig. 2), as well as a more substantial stand for use in the laboratory (see Fig. 1).

The high degree of exactness of the new Leitz polarimeter has permitted to design apart from the model with ½ standard tube length (model "B" for tubes 94.7mm), an exceptionally small polarimeter for use with ¼ standard tubes (model "A" for tubes 47.35mm). Although the use of the ¼ standard tube doubles the chances of error on account of the involved equation, yet due to the optical and mechanical precision of the instrument, the shorter tube suffices in many cases for all practical requirements.

Model "B"—is available for use with ½ standard as well as ¼ standard tubes; when ¼ standard tubes are used, the percentage reading should be multiplied by 2.

Model "A"—is adapted for use with ¼ standard tubes only; the percentage scale of the compensator being corrected for this tube length.

Code Word	Cat. No.	Designation	Price
HACIBEEN	**34350**	**R-Polarimeter**—*Model "A"*—right-rotary, with ¼ standard tube, **without stand, in case**	$
HABOLAN	**34352**	**R-Polarimeter**—*Model "A"*—right-rotary, with ¼ standard tube, **with foldable stand, in case**	
HACOBLAD	**34354**	**R-Polarimeter**—*Model "B"*—right-rotary, with ½ standard tube, **without stand, in case**	
HACULOEM	**34356**	**R-Polarimeter**—*Model "B"*—right-rotary, with ½ and ¼ standard tubes, **with foldable stand, in case**	
HASIGOLF	**34358**	**Laboratory Stand,** for R-Polarimeters Nos. 34350-34356 (see Fig. 1)	
HACYELIE	**34360**	**Foldable Stand,** for R-Polarimeters Nos. 34350-34356 (see Fig. 2).	
HABABOAT	**34362**	**½ Standard Tube**	
HABEBEUK	**34364**	**¼ Standard Tube**	

Pages 241 to 249 cover

MICRO-PROJECTION APPARATUS

Particularly in teaching students the use of the microscope, the importance of direct projection of mounted microscopical specimens is more and more recognized by schools. The advantage of demonstrating a microscopical specimen before an entire class and discussing as well as delineating the structure is readily evident. This method of teaching furthers within the students' minds a clear understanding of the importance of the microscope and its application to laboratory analysis. In addition, the lecturer is able to demonstrate to his classes such microscopical material as is not available for individual preparation for the students.

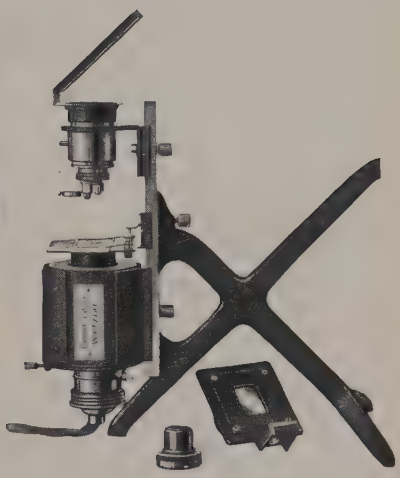
The Micro-Projectors frequently offered are either of inferior workmanship and consequently of little value in teaching, or they are too elaborate in construction to permit of practical and easy manipulation.

Amongst the various models of Micro-Projectors listed in the succeeding pages, are found types of exceedingly simple construction to serve excellently for high and elementary schools and again, types of more elaborate design which are likely to be given preference for lecture work in universities.

SIMPLE MICRO- AND FILM-SLIDE PROJECTOR "URDIA"

Arranged for Micro-Projection with object in vertical position

Arranged for the Projection of Film Slides



Arranged for Micro-Projection with object in horizontal position when projecting solutions or hanging drop-slides

Size of Projector: 24cm (9½ in.) high x 25cm (10 in.) long
Weight: 4 lbs. without case

This projector is chiefly offered for elementary teaching in Biology, Botany and allied studies and therefore, it is constructed to be available only for magnifications as rendered by the objectives listed. The projector is applicable for the following modes of projection:

1. Micro-Slides;
2. Specimens suspended in solution;
3. Hanging Drop-Slides;
4. Large transparent specimens up to 70mm diameter;
5. Film-Slides;
6. As drawing apparatus by tracing images projected vertically on table.

In offering this new and simple micro-projector we are in a position to meet the constantly increasing demand for an inexpensive yet most efficient micro-projection apparatus for biological teaching. **This instrument can likewise be used for the still projection of film slides, a feature of eminent importance for lecture purposes.**

It is equipped with standard Leitz objectives and yields pictures of maximum brilliancy and sharpness. It is available for the projection of all preparations of plant- and animal-cells, tissues, insects, embryos, etc.

Source of Light—Consists of a 6-volt lamp, 50cp. The cord and plug furnished connects to any light circuit and uses a resistance for direct current or employs a transformer for alternating current. (The resistances or transformers are listed separately; see page 242.) If no electric current is available, it may be used on a 6-volt storage battery. The lamp is easily centered by means of three screws situated at the rear of the lamp housing.

A: Micro-Projection—Arranged as per illustration shown on the left-hand side, is carried out through the use of a divisible objective (40-24mm focal length). The object stage supplied with small aperture and strong condenser is used. Objectives are inserted into the objective sleeve, the lens facing the object stage. Coarse focus is accomplished through sliding the objective sleeve on the optical track. Fine adjustment is provided for through micrometer screw movement at the objective sleeve. After the lamp has been centered, the lamp housing is moved until maximum brilliancy is obtained.

B: Projection of specimens in solutions and hanging drop-slides—Arranged as per illustration on right-hand side, is provided for in an entirely satisfactory manner. (The reflecting mirror is silvered on the outside and to prevent damage to its surface the latter should not be touched.)

C: Large Section Projection—Is obtained with the three-lens objective 64mm focal length. The object stage with small aperture is easily removed by loosening a screw and replaced by a second stage provided with a condenser of larger diameter. After removing the micro objective, the 64mm lens is inserted in place. Focus is obtained by moving the objective support and using the worm gear.

(Continued on page 242)

Simple Micro- and Film-Slide Projector "URDIA"—(Continued)

D: Still Projection of Film-Slides—Is accomplished by arranging the instrument as suggested under "C," and illustrated by the center figure on page 241. The film-glide or holder, listed under No. 25943a, is fastened to the object stage and permits any picture of the entire length of film strip to be projected. In this manner film projection is accomplished most satisfactorily.

E: As Drawing Apparatus—The instrument is arranged as per illustration on left-hand side (*page 241*) except that the reflecting mirror is attached to the objective tube and directs the image upon the table where it can be traced as accurately as is possible with even larger and more expensive apparatus.

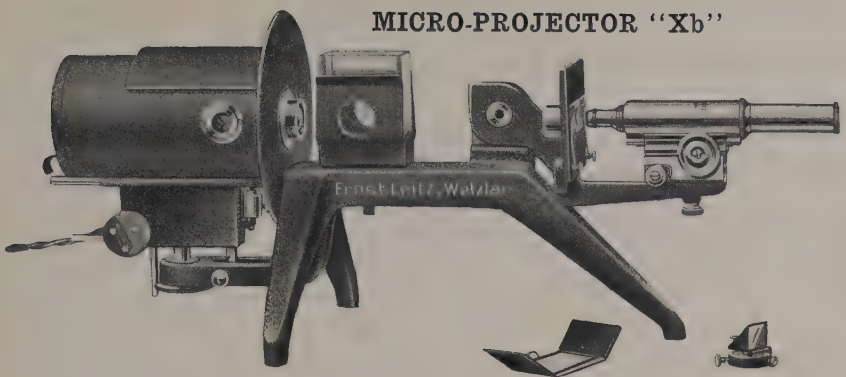
Magnification Table

Screen Distance	Objective 64mm	Divisible Objective (included in Nos. 25940 and 25942)	
		Section 40mm	Section 24mm
4 ft.	20X	30X	60X
8 ft.	40X	60X	120X
12 ft.	60X	90X	180X
20 ft.	100X	150X	300X

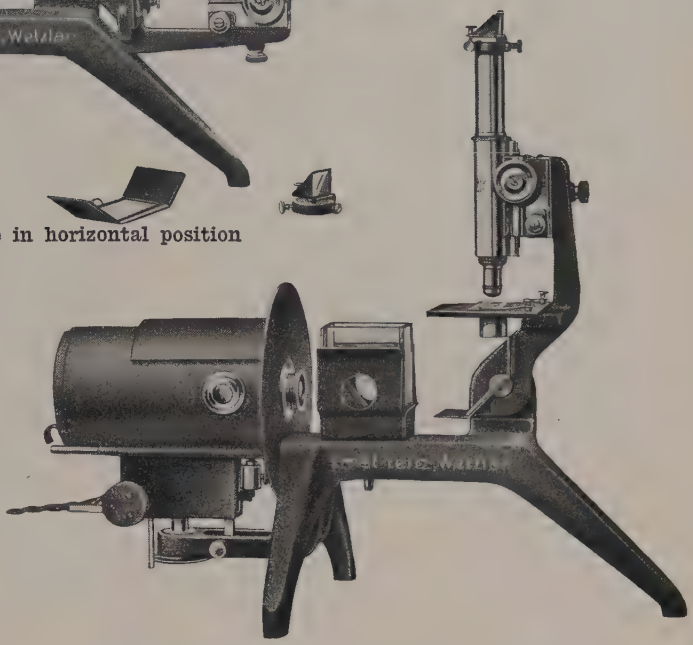
Note: At screen distances of 20 ft. the section 40mm of divisible objective renders a field 5 ft. in diameter and section 24mm at a distance of 15 ft., a field 7 ft. in diameter. At longer or shorter distance the size of field increases or decreases proportionately.

Code Word	Cat. No.	Designation	Price
URMIK	**25940**	**Simple Micro-Projector,** including: tilting stand; bulb, 6-volt, in light-proof housing; object stage with condenser; divisible objective 24 and 40mm; outside silvered reflecting mirror for drawing purposes; cord and plug	$
URDIA	**25942**	**Simple Micro-Projector,** same as No. 25940, **but including the following additional accessories for the projection of large transparent sections and film strips:** second object stage with large opening and special condenser; film-glide for projection of film strips; objective 64mm	
		Note: *If the projector No. 25940 is originally ordered without the additional accessories listed under No. 25942, these items can be purchased at a later date, at the following prices:*	
USLAC	**25943**	**Second Object Stage,** with large opening and special condenser	
USLEF	**25943a**	**Film-Glide,** for the projection of film strips	
USLIR	**25943b**	**Objective 64mm,** for the projection of film strips and large sections	
ULAMO	**25944**	**Bulb,** 6-volt, 50 C.P., extra	
REMAB	**25946**	**Rheostat, 110**-volt, **D.C.**	
REMID	**25948**	**Rheostat, 220**-volt, **D.C.**	
RADSH	**25949**	**Transformer, 110**-volt, **A.C.**	
RADVY	**25951**	**Transformer, 220**-volt, **A.C.**	
		Note: *When the projector is to be utilized with current from the light socket a rheostat or transformer must be ordered.*	
ELROS	**25952**	**Carrying Case,** accommodating complete projector and one rheostat or transformer	

MICRO-PROJECTOR "Xb"



Arranged with microscope in horizontal position



Arranged with microscope in vertical position
(For projecting living objects, even such active specimens as paramoecium and vorticella)

Being permanently aligned, the construction of model "Xb" will readily impress all who use micro-projectors of the advantage of having the individual units rigidly adjusted to each other. The manipulation involves only the interchange of condensers, as required for low and high magnifications, the initial centering of the light rays and focusing of the microscope.

A: Compact Size—Extreme length is 72cm (29 in.) and extreme height (microscope arranged horizontally) is 33cm (13½ in.); the weight including the arclamp is 20 lbs. The apparatus is easily portable from one room to another.

B: Optical Alignment — The apparatus is supported by a tripod of cast iron and all individual units are cast as a permanent part of the base. It therefore follows that all parts which are a factor in the optical alignment are fixed at the correct distance and no adjustment to height is required, the optical axis has been accurately and permanently gauged and set at the factory.

This construction eliminates the necessity of skilled operators and offers positive assurance of time saving and **for satisfactory results being obtained without the least difficulty.**

C: Source of Light—An automatic arclamp, feeding the carbons by clockwork mechanism, has been selected, due to its concentrated light source and high candle power. This lamp has proven eminently satisfactory in connection with most of our larger model micro-projectors and **is distinctly superior to any other form of light source.** The lamp is mounted to a socket, cast to the supporting stand, and provided with centering motions in two directions; viz., vertical and horizontal. The only adjustment required is to center the light beam to the middle of the microscope condenser.

For direct current, we recommend the use of an 8-ampere rheostat and for alternating current the use of a 10-ampere rheostat. (It is a fact that the effective light intensity of alternating current is approximately only one-half that of direct current.)

Note: *Due to the small diameter of the lenses used in micro objectives and the comparatively long distances at which the projector "Xb" can be used, we do not advocate the use of any form of incandescent light source with this instrument. Incandescent lamps can only be employed successfully when short projection distances are involved which naturally entail an appropriate reduction in magnification.*

D: Condensing System—This lens unit is of high optical correction and is stationary mounted to the front of the lamp housing. No adjustment of this unit is ever necessary.

E: Microscope—Consists of a strong handle arm, jointed to a cast-iron projection of the supporting stand.

E-1: Microscope Tube—Represents a standard unit of a compound microscope and is provided with rack and pinion for coarse focus as well as micrometer screw for fine adjustment (the latter has a safety device, protecting both objectives and specimens against injury). The tube is equipped with standard triple dustproof nosepiece.

E-2: Stage—Is of square pattern, with stage clips, having sleeve underneath for the reception of substage condensers.

E-3: Micro-Objectives—Our standard micro objectives are used in connection with the projector "Xb" and those best suited to give a proper range of magnification are:

No. 22005	**4.3X**	(32mm)	**No. 22012**	**20X**	(9mm)
No. 22006	**6X**	(24mm)	**No. 22014**	**30X**	(6mm)
No. 22010	**14X**	(13mm)	**No. 22016**	**45X**	(4mm)

(*Continued on page 244*)

Micro-Projector "Xb"—(Continued)

E-4: Micro Oculars—In our standard equipment, for distances up to 17 ft. from the screen, we include *"Huyghenian"* ocular 4X, while in our standard equipment, for distances up to 35 ft., we include *"Huyghenian"* ocular 2X.

E-5: Micro Condensers—The required illumination will be obtained by means of two condensers, one for low and the other for high power magnifications. Both condensers are for insertion into the sleeve on the under-surface of the microscope stage. **In the magnification table below we have enumerated with which objectives the low power and the high power condensers are used** and if these suggestions are followed, satisfactory results will be obtained.

F: Cooling Chamber—Through the use of a cooling cell (included in the equipments) injury to specimens by heat is precluded.

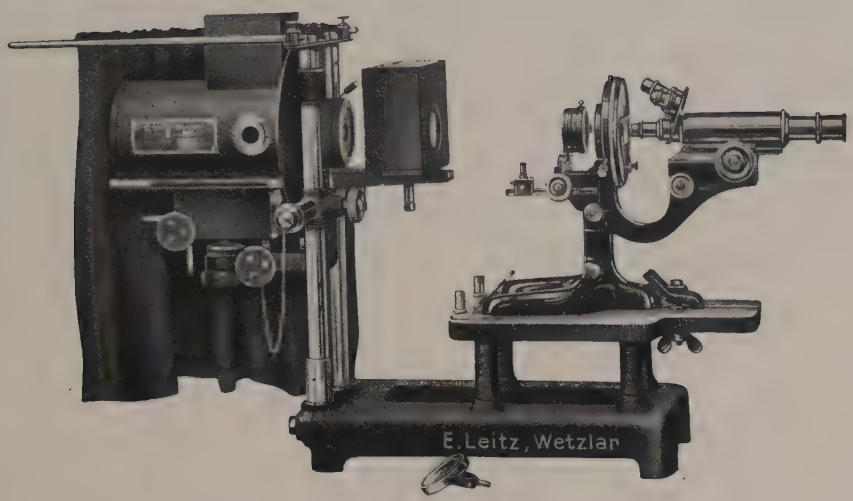
Objective				Magnifications at a screen distance of:											
Designation	Focal Length mm	Mag. No.	Condenser to be used	Ocular	4 ft.	8 ft.	10 ft.	14 ft.	18 ft.	Ocular	12 ft.	16 ft.	20 ft.	28 ft.	36 ft.
22005	32	**4.3X**	low	H-4X	80	160	200	280	360	H-2X	120	160	200	280	360
22006	24	**6X**	low	H-4X	120	240	300	420	540	H-2X	174	230	290	410	500
22010	13	**14X**	low	H-4X	270	540	670	940	1200	H-2X	410	550	680	950	1220
22012	9	**20X**	high	H-4X	320	640	800	1120	1440	H-2X	570	770	960	1350	1730
22014	6	**30X**	high	H-4X	560	1120	1400	1940	2520	H-2X	860	1150	1440	2010	2600
22016	4	**45X**	high	H-4X	840	1680	2100	2940	3780	H-2X	1320	1760	2200	3100	3960

Note: The size of the screen image at a screen distance of 14 ft. when using Ocular H-4X, or at a screen distance of 28 ft. when using ocular H-2X, **is about 5.5 ft. in diameter.** At shorter or longer screen distances the size of the image is proportionately smaller or larger, as the case may be.

Code Word	Cat. No.	Designation	Price
POLIC	**25701**	**Micro-Projector "Xb",** complete with automatic-feed arclamp; rheostat **8-ampere, 110-volt D.C.,** condensing unit; cooling cell; inclinable microscope with triple dustproof nosepiece; *"Huyghenian"* **Ocular 4X;** for screen **distances up to 18 ft.; without** micro condensers and **without** objectives	$
POLKZ	**25703**	**Same as No. 25701,** but including rheostat **8-ampere, 220-volt D.C.**	
POLLV	**25705**	**Same as No. 25701,** but including rheostat **10-ampere, 110-volt A.C.**	
POLMS	**25707**	**Same as No. 25701,** but including rheostat **10-ampere, 220-volt A.C.**	
POLNT	**25709**	**Micro-Projector "Xb",** complete with automatic-feed arclamp; rheostat **8-ampere, 110-volt, D.C.;** condensing unit; cooling cell; inclinable microscope with triple dustproof nosepiece; *"Huyghenian"* **Ocular 2X;** for screen **distances up to 36 ft.; without** micro-condensers and **without** objectives	
POLOD	**25711**	**Same as No. 25709,** but including rheostat **8-ampere, 220-volt D.C.**	
POLPH	**25713**	**Same as No. 25709,** but including rheostat **10-ampere, 110-volt A.C.**	
POLRP	**25715**	**Same as No. 25709,** but including rheostat **10-ampere, 220-volt A.C.**	
		Note: *We recommend for selection, the following micro objectives to be used with projector "Xb":*	
ACABA	**22005**	**Achromatic Objective** (*Dry*), 32mm, N.A. 0.15, **Magn. 4.3X**	
ACEDU	**22006**	**Achromatic Objective** (*Dry*), 24mm, N.A. 0.20, **Magn. 6X**	
ACODO	**22010**	**Achromatic Objective** (*Dry*), 13mm, N.A. 0.40, **Magn. 14X**	
ACLAN	**22012**	**Achromatic Objective** (*Dry*), 9mm, N.A. 0.45, **Magn. 20X**	
ACATI	**22014**	**Achromatic Objective** (*Dry*), 6mm, N.A. 0.65, **Magn. 30X**	
ACTIS	**22016**	**Achromatic Objective** (*Dry*), 4mm, N.A. 0.85, **Magn. 45X**	
PROOD	**25720**	**Micro Condenser No. 1,** for low power (to be used with objectives Nos. 22005, 22006 and 22010)	
PROPU	**25722**	**Micro Condenser No. 2,** for high power (to be used with objectives Nos. 22012, 22014 and 22016)	
PRORK	**25724**	**Total Reflection Prism,** for use with microscope when arranged for projection in vertical position	
PROSO	**25726**	**Carbons,** for arclamp, when used with **direct current** (*pair consists of one each carbon 150x8 and 150x6mm*) **per 25 pairs**	
PROTY	**25728**	**Carbons,** for arclamp, when used with **alternating current** (*pair consists of two carbons 150x7mm*) **per 25 pairs**	
PORIT	**25920**	**Table,** on four adjustable legs, with inclinable table plate, for the support of micro-projector "Xb"	

MICRO-PROJECTOR "Xa"
for High Magnifications

Model "Xa" has been especially constructed to permit micro-projection under high magnifications, in addition to medium and low powers, and the ***screen images obtained with oil immersion objectives are exceedingly brilliant, clear in definition, and remarkably flat over the entire field.*** *The micro-projector "Xa" permits the use of standard microscopes so that it consequently will not be necessary to order a special microscope with the instrument if a suitable microscope stand is available.*



The various units comprising the micro-projector "Xa" are mounted to a heavy cast iron frame support. The illuminant with its various component parts is mounted to two vertical pillars fastened to the rear end of the supporting frame. On these pillars the illuminant may be raised and lowered so as to direct the light rays at the required height towards the microscope. When the microscope is arranged in vertical position, the lamp has to be lowered so that the illuminating rays meet the mirror; while when inclining the microscope to horizontal position, the lamp is raised for directing the light rays centrally into the substage condenser.

The illuminant comprises an automatic-feed arclamp (the carbons being manipulated by clockwork mechanism). It is supplied with two centering screws affording a displacement sideways and in respect to height so that the crater may be properly centered to the illuminating system and microscope condenser respectively. On direct current the lamp is used with 8 amperes and on alternating current with 12 amperes. On direct current, a rheostat for 8 amperes, and on alternating current, one for 12 amperes will have to be ordered for use with the arclamp. The lamp is enclosed in a metal housing, the latter being surrounded by a cloth curtain to avoid any light from escaping which otherwise would be disturbing to the audience.

An aspheric lens has been selected for the concentration of the light rays and this is mounted on a separate optical bench attached to the front of the lamp housing. The lens being made to slide upon the optical bench, it affords means of concentrating the rays in accordance with the requirements for low, medium and high power objectives. An iris diaphragm is mounted immediately in front of the aspheric illuminating lens to serve the rays to be sufficiently screened so as to avoid overheating of micro specimens. To afford the preparations a further protection against overheating, a cooling cell has been provided and this is likewise attached to the small optical bench, in front of the iris diaphragm.

By means of four pillars, the microscope base plate is mounted to the supporting frame. Clamps have been provided to hold the foot of the microscope securely in place to avoid accidentally tipping over particularly when the microscope is inclined to horizontal position. As mentioned before, any standard microscope can be used in connection with the projector "Xa" but it is to be borne in mind, however, that such a microscope be in good working condition and this in respect to its micrometer screw as well as other mechanical fittings so that a maximum amount of efficiency may be expected of it while projecting.

Every one of the standard micro objectives can be utilized, likewise oil immersions. If the microscope used is provided with a wide tube permitting the draw tube with screw collar to be removed, then it is likewise adaptable for projection with wide angle objectives such as "Micro-Summars." For use with objectives of 3.2X (40mm) to 14X (13mm), we recommend the *"Huyghenian"* ocular 4X while when utilizing objectives of higher magnification, it is suggested to use with them the *"Periplan"* ocular 4X. A somewhat larger screen image is obtained when utilizing the special projection ocular 6X (42mm) which is particularly recommended for use with apochromatic objectives for projection. If comparatively long screen distances are involved, the *"Huyghenian"* or *"Periplan"* oculars 2X or 3X are preferably employed. *(Continued on page 246)*

Micro-Projector "Xa"—(Continued)

In order to obtain a maximum efficiency in the illumination of the micro specimen, we recommend that the microscope stand used for projection be equipped with the special one-lens condenser for low power objectives and the divisible three-lens condenser N.A 1.40. The latter condenser, having separable lens units, affords utilization of that portion of the condenser as is required dependent upon the objective employed. (The table on page 247 discloses the magnification rendered when using various combinations of objectives and oculars at different screen distances; this table furthermore gives information as to the proper application of the condensers dependent upon what objectives are employed.)

Code Word	Cat. No.	Designation	Price
USLOM	**25750**	**Micro-Projector "Xa",** as described, consisting of: cast-iron frame support; two vertical pillars, mounted thereto an automatic-feed arclamp in metal housing with cloth screening curtain, adjustable in height; optical bench with aspheric illuminating lens, iris diaphragm, and cooling chamber in housing; microscope base plate with clamping device; complete with 10 ft. cord and plug.....	$
POBIL	**25752**	**One-Lens Condenser,** for objectives 3.2X (40mm) to 14X (13mm)	
ILANY	**22486**	**Three-Lens Divisible Condenser,** N.A. 1.40, with demountable lens segments and iris diaphragm, for use with medium and high power objectives.....	
POKON	**22547**	**Centering Adapter,** for the accommodation of condenser No. 22486; (the condenser screws into the centering adapter and the latter inserts into the substage sleeve).....	
PRORK	**25724**	**Total Reflecting Prism,** for use with microscope when arranged for projection in vertical position.....	
HYKUL	**22038**	*"Huyghenian"* **Ocular, 4X** (*for screen distances up to 16 ft.*)	
PERIV	**22065**	*"Periplan"* **Ocular, 4X** (*for screen distances up to 16 ft.*)	
PERPY	**25754**	**Special Projection Ocular, 6X** (42mm) (*for screen distances up to 16 ft.*).....	
UAWAELYN	**25756**	**Micro-Projector "Xa", complete equipment as listed above:**	
		For use of Micro-Projector "Xa" at screen distances exceeding 16 ft., we recommend the following oculars:	
UAWYPOST	**25758**	*"Huyghenian"* **Ocular, 3X,** and *"Periplan"* **Ocular, 3X**.....	
		OR:—	
PRUTU	**25760**	*"Huyghenian"* **Ocular, 2X,** and *"Periplan"* **Ocular, 2X**.....	
		Dependent upon current conditions, either of the rheostats listed below may be selected for use in connection with the Micro-Projector "Xa":	
REDON	**25762**	**Rheostat, 110-volt, D.C.,** 8-ampere.....	
REORI	**25764**	**Rheostat, 220-volt, D.C.,** 8-ampere	
RAHYPRES	**25766**	**Rheostat, 110-volt, A.C.,** 12-ampere.....	
RAJAPRYN	**25768**	**Rheostat, 220-volt, A.C.,** 12-ampere.....	
PROSO	**25726**	**Carbons,** for arclamp, when used with **direct current,** *pair consists of one each carbon 150x8 and 150x6mm*..... **per 25 pairs**	
PROTY	**25728**	**Carbons,** for arclamp, when used with **alternating current,** *pair consists of two carbons 150x7mm*..... **per 25 pairs**	
PORIT	**25920**	**Table,** on four adjustable legs, with inclinable table plate, for the support of micro-projector "Xa"	

(*Continued on page 247*)

Micro-Projector "Xa"—(Continued)

Optical Equipment for Micro-Projection

(The objectives listed below are especially recommended for micro-projection due to their well-balanced assortment)

Code Word	Cat. No.	Magn. No.	Equivalent Focal Length mm	Type of Objective	N.A.	Price
ACUBE	**22002**	**3.2X**	40	Achromat (*Dry*)	**0.12**	$
ACEDU	**22006**	**6X**	24	Achromat (*Dry*)	**0.20**	
ACORA	**22008**	**10X**	16	Achromat (*Dry*)	**0.25**	
ACLAN	**22012**	**20X**	9	Achromat (*Dry*)	**0.45**	
APONN	**22054a**	**40X**	4	Apochromat (*Dry*)	**0.95**	
FLUCA	**22024**	**42X**	4.2	Fluorite (*Dry*)	**0.85**	
FLUIM	**22031**	**54X**	3.45	Fluorite (*Oil Im.*)	**0.95**	
FLURI	**22033**	**70X**	2.6	Fluorite (*Oil Im.*)	**1.30**	
FLUES	**22034**	**95X**	1.95	Fluorite (*Oil Im.*)	**1.32**	

Table of Magnifications for Micro-Projection at various screen distances

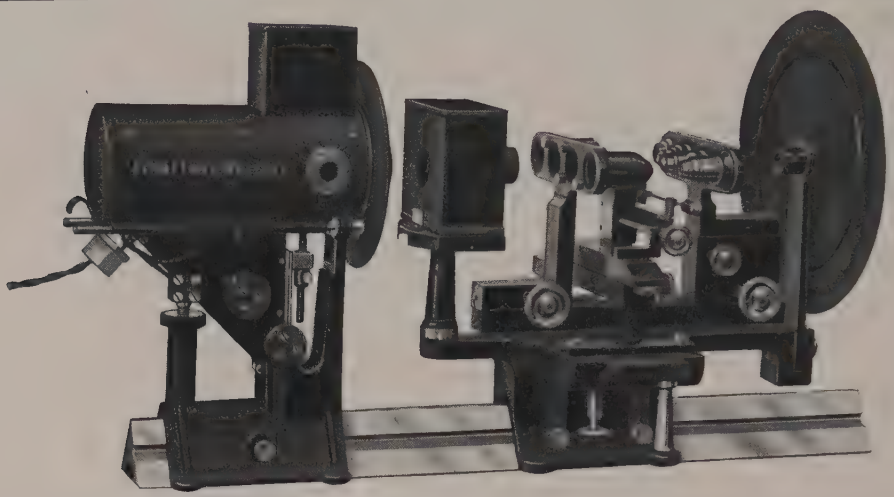
Objectives (Assortment as listed above)		**Magnifications at Screen Distances of:**											
Cat. No.	Initial Magn.	Ocular	3½ ft.	7 ft.	10 ft.	13 ft.	16 ft.	Ocular	14 ft.	17 ft.	20 ft.	27 ft.	34 ft.
22002	3.2X	"*Huyghenian*" 4X	50	100	150	200	250	"*Huyghenian*" 2X	100	130	150	200	250
22006	6X	"*Huyghenian*" 4X	90	180	270	360	450	"*Huyghenian*" 2X	180	230	270	360	450
22008	10X	"*Huyghenian*" 4X	160	320	480	640	800	"*Huyghenian*" 2X	320	400	480	640	800
22012	20X	"*Huyghenian*" 4X	320	640	960	1280	1600	"*Huyghenian*" 2X	640	800	960	1280	1600
22054a	40X	"*Periplan*" 4X	640	1280	1920	2560	3200	"*Periplan*" 2X	1280	1600	1920	2560	3200
22024	42X	"*Periplan*" 4X	670	1340	2010	2680	3350	"*Periplan*" 2X	1340	1675	2010	2680	3350
22031	54X	"*Periplan*" 4X	860	1720	2580	3440	4300	"*Periplan*" 2X	1720	2150	2580	3440	4300
22033	70X	"*Periplan*" 4X	1120	2240	3360	4480	5600	"*Periplan*" 2X	2240	2800	3360	4480	5600
22034	95X	"*Periplan*" 4X	1520	3040	4560	6080	7600	"*Periplan*" 2X	3040	3800	4560	6080	7600

Note: 1) The screen image at a distance of 13 ft. (using ocular 4X) or at 27 ft. (using ocular 2X) measures 5½ ft. in diameter.

2) The special projection ocular 42mm (*listed under No. 25754 on page 246*), having an initial magnification of **6X** can therefore be used for comparatively short screen distances only so that at increased distances one of the lower power oculars should be employed.

PRECISION MICRO-PROJECTOR "XI"
with Synchronic Quick-Changing Device for Objectives and Condensers

Model "XI" represents the most ideal apparatus for micro-projection of utmost efficiency. It is available for the complete range of micro objectives including oil immersions of highest magnification. Model "XI" involves an entirely new construction affording a quick change from one objective to another and similarly a quick shift from one condenser to another for use of the objective employed.



The projector "XI" consists of a strong wooden base plate mounted thereto a triangular optical bench. The illuminant is supported on a rider with clamping screws for attachment to the optical track. An automatic-feed arclamp (carbons being manipulated by clockwork mechanism), is held by a vertical rod inserted into a socket being an integral part of the rider. The lamp is provided with centering screws affording a displacement side-ways and in respect to height so that the crater may be properly centered to the illuminating system and microscope respectively. The lamp is enclosed in a metal housing which precludes the escape of any light. On direct current, the lamp is used with 8 amperes and on alternating current with 12 amperes. A rheostat being required for use with the lamp, one of 8 amperes for direct current and 12 amperes for alternating current, is provided. The lamp housing is equipped in front with a two-lens illuminating system which renders parallel rays. A cooling cell enclosed by a metal housing is supported on a vertical pillar, the latter mounted to the microscope rider. This cell protects the micro specimen against over-heating. The housing of the cooling chamber is equipped with a tele-lens system consisting of two bi-convex lenses. An iris diaphragm mounted between these two lenses is arranged in such a position as to be situated within the focal point of the illuminating rays. The second lens of the tele-system likewise renders a parallel pencil of rays. In this manner, a thorough protection is offered against over-heating of specimens under medium and high power magnifications.

The microscope rider, aside from carrying a cooling chamber with tele-lens unit, supports on a bracket with rack and pinion motion, a slider for a combination of four different condensers, an especially devised mechanical stage for the micro slide and again on a separate bracket provided with rack and pinion coarse focus and micrometer screw for fine adjustment, a slider for four different microscope objectives. At the end of the microscope rider is attached by a vertical rod the sleeve for the reception of the projection ocular and this rod carries a circular screening disc to prevent stray light from reaching the projection screen.

The slider holding four different condenser units permits an immediate change from one condenser to another and by rack and pinion to focus these condensers precisely. The microscope proper being provided with a slider for four different objectives affords an immediate change from the objective to another dependent upon the magnification desired. **It is readily evident that through such synchronic shift of condensers and objectives, a microscopic preparation may be instantly projected under a variance of different magnifications and this without the least loss of time.**

Objectives and condensers are so parfocalized to each other that when applying them under the change of different magnifications, **the focus once obtained will remain in adjustment irrespective of the change made.** The specially devised mechanical stage is provided with mechanical motions at right angles to each other and these movements being of utmost precision, a slide may be oriented with micrometric accuracy. The holder with ocular sleeve may be swung aside in case of wide angle objectives being utilized, since these naturally do not require the application of an ocular.

In order to avoid any stray light acting disturbingly upon the audience, the complete apparatus is surrounded by a cloth curtain screen supported by metal rods.

The complete series of microscope objectives including oil immersions of highest magnifications as well as the "Micro-Summars" 24, 35 and 42mm, are readily available for use with projector "XI."

(*Continued on page 249*)

Precision Micro Projector "XI"—(Continued)

The *"Huyghenian"* ocular 4X is utilized in connection with low power objectives at screen distances up to 16 ft. and for medium and high power objectives at this screen distance, the special projection ocular 6X (42mm) is used. When employing the projector "XI" at screen distances exceeding 16 ft., we recommend the *"Huyghenian"* oculars 2X and 3X for low power objectives and the *"Periplan"* oculars 2X and 3X for medium and high power objectives. (The table on page 247 discloses the magnification rendered when using various combinations of objectives and oculars at different screen distances.)

If utmost efficiency in micro-projection is desired, consideration should be given to the projector "XI." It represents the latest word in construction of micro-projectors and completely eliminates any such shortcomings which heretofore have given frequent rise to more or less unsatisfactory experiences.

Code Word	Cat. No.	Designation	Price
		Precision Micro-Projector "XI" with *"Synchronic Quick-Changing Device"* for objectives and condensers, consisting of:	
POGRU	**25800**	**Wooden Base-Plate,** with triangular optical bench 700mm long mounted thereon.....	$
UAWEFERS	**25802**	**Rider,** with automatic-feed arclamp (clockwork mechanism) used on direct current at 8 amperes and on alternating current at 12 amperes; complete with hard glass collimator illuminating system.....	
UAWIELSE	**25804**	**Rider,** with cooling chamber 100x100x50mm.....	
PLYPX	**25806**	**Microscope on Rider,** including support with tele-illuminating system; bracket with rack and pinion focusing device carrying synchronic slider with four different condensers; mechanical stage having cross motions at right angles to each other; bracket with rack and pinion for coarse focus and micrometer screw for fine adjustment, carrying synchronic slider for four objectives (*without objectives*); ocular support on swinging arm; *"Huyghenian"* ocular 4X and special projection ocular 6X (42mm), complete with 10 ft. cord and plug.....	
UAWUVERD	**25808**	**Cloth Screening Curtain,** with supporting rods....	
PLYRT	**25810**	**Precision Micro-Projector "XI", complete equipment as listed above, for screen distances up to 16 ft.:**	$
		The assortment of objectives (*listed below*) which are carefully parfocalized with the four condensers included in No. 25806, is especially recommended for use with Micro-Projector "XI":	
ACEDU	**22006**	**Achromatic Objective** (*Dry*), **6X** (24mm), N.A. 0.20 (to be used with "Huyghenian" ocular 4X or 2X respectively, dependent upon the screen distance) ...	
ACLAN	**22012**	**Achromatic Objective** (*Dry*), **20X** (9mm), N.A. 0.45 (to be used with special projection ocular 6X (42mm), or *"Huyghenian"* ocular 2X respectively, dependent upon the screen distance).....	
APONN	**22054a**	**Apochromatic Objective**—*Special* (*Dry*), **40X** (4mm), N.A. 0.95 (to be used with special projection ocular 6X (42mm), or *"Periplan"* ocular 2X respectively, dependent upon the screen distance).....	
SUMIT	**28245**	**"Micro-Summar"** 42mm with iris diaphragm (to be used without ocular)	
PLYSH	**25812**	**Complete Assortment of Objectives listed above:**	
		For use of Micro-Projector "XI" at screen distances exceeding 16 ft., we recommend the following oculars:	
UAWYPOST	**25758**	*"Huyghenian"* **Ocular, 3X,** and *"Periplan"* **Ocular, 3X**.....	
		OR:	
PRUTU	**25760**	*"Huyghenian"* **Ocular, 2X,** and *"Periplan"* **Ocular, 2X**.....	
		Dependent upon current conditions, either of the rheostats listed below may be selected for use in connection with the Micro-Projector "XI":	
REDON	**25762**	**Rheostat, 110**-volt, **D.C.,** 8-ampere.....	
REORI	**25764**	**Rheostat, 220**-volt, **D.C.,** 8-ampere.....	
RAHYPRES	**25766**	**Rheostat, 110**-volt, **A.C.,** 12-ampere.....	
RAJAPRYN	**25768**	**Rheostat, 220**-volt, **A.C.,** 12-ampere.....	
PROSO	**25726**	**Carbons,** for arclamp, when used with **direct current,** *pair consists of one each carbon 150x8 and 150x6mm*.....**per 25 pairs**	
PROTY	**25728**	**Carbons,** for arclamp, when used with **alternating current,** *pair consists of two carbons 150x7mm*.....**per 25 pairs**	
PORIT	**25920**	**Table,** on four adjustable legs, with inclinable table plate, for the support of micro-projector "XI".....	

Pages 251 to 256 cover

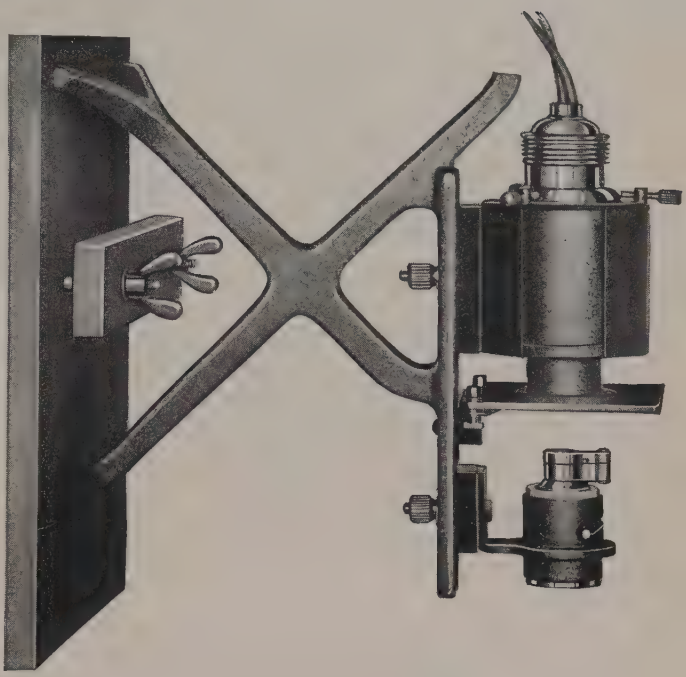
COMBINED DRAWING AND PROJECTION APPARATUS

The time and thought given to carefully prepared drawings made from microscopical preparations is considered of greatest value in biological work. When a single drawing is required under moderately high power or even high magnification, the microscope alone, or the microscope aided by a camera lucida is usually used. Whole mounts of invertebrates and embryological material from which a number of neatly executed consecutive sections are to be drawn often prove a rather discouraging task to teachers and students not especially skilled in drawing. On pages 251-258, we have listed several models of drawing and projection apparatus, some of them being of rather simplified pattern and others more elaborately equipped. The former serve for routine drawings in student laboratories and the latter, aside from being available for drawing purposes, are likewise most satisfactorily used as micro-projectors.

SIMPLIFIED MICRO DRAWING AND PROJECTION APPARATUS "SPD" for Student Laboratories

according to suggestions by Joseph M. Thuringer,
Professor, Department of Histology and Embryology, University of Oklahoma

Apparatus "SPD" complete contained in drawing box



Apparatus "SPD" proper
(*disclosing details of its construction not visible to the left*)

In teaching embryology, the recognized procedure is to have each student reproduce outlined drawings of transverse sections of embryos at a certain number of levels as determined by some external or internal feature of the embryo. The particular sections used are marked on the slide in order that they may be readily recognized for future study. The filling in of the details is accomplished with the aid of higher magnifications of the microscope. Little difficulty is encountered in the latter phase of the work if an accurate outline of the entire section has been made. An attempt, however, to make a number of series of outlined drawings by free hand, presents a time-consuming occupation. A long-felt demand has existed on the part of teachers to have available a simple micro-projector or drawing apparatus especially arranged to expedite these drawings.

Heretofore, a number of apparatus have been offered for work of this kind but most of them are too costly to be used in a routine manner by students. In recent years, special low power projection devices have likewise been supplied for use in conjunction with lantern slide projectors. These have their place as well as their limitations. Aside from the prohibitively high cost of the apparatus, the slides are usually held to a vertical stage by means of clips which frequently ruin the slides. The heat from the projection lamp also caused considerable difficulties since it quite often mutilated the mounting medium. Furthermore, a change of magnification was only possible by realigning the entire apparatus.

The simple micro drawing and projection apparatus which is herewith offered presents to the teaching profession an instrument which meets all the requirements of a good and reasonably priced projector for low power to medium high power work in student laboratories.

Construction: Apparatus "SPD" can be supplied in two distinct forms; viz., either mounted within a box screening the drawing surface against external light or on a vertical track attached to a drawing board. In the latter model, the apparatus is accompanied by a foldable screening device to create sufficient contrast at the drawing surface by excluding the external light.

To the vertical track is mounted a metal bracket holding the optical bench. The optical bench is provided with a lamp housing on adjustable support, the lamp furnished in centerable socket. The source of light consists of a bulb 6-volt, 50 CP. The lamp housing, being movable, can thereby be adjusted in proper relation to the specimen to be illuminated. In front of the lamp housing is a screening disc holding a condenser unit. The object stage measures 60 x 63mm

(*Continued on page 252*)

Simplified Micro Drawing and Projection Apparatus "SPD"—(Continued)

and is provided with an opening of 20mm. The stage is mounted to the optical bench in a stationary manner.

A tubular objective holder with thread is supported by a sliding socket adjustable upon the optical bench. The objective holder being provided with a worm gear affords accurate focus to the objective. A double divisible objective acts as magnifying medium. This objective when only one lens unit is used renders a magnification of 6X and when both lens segments are used together, a magnification of 12X. Dependent upon the distance from the objective to the drawing surface, the one lens unit renders a magnification from 8X to 20X and the 2 lens segments combined, a magnification from 16X to 40X. The double divisible objective is not used with oculars and consequently projects the specimens within a wide angle upon the drawing surface, no ocular diaphragm restricting the size of the field.

Note: *A special adapter is furnished which can be inserted into the objective holder in place of the double divisible objective and this adapter serves the purpose of likewise using standard micro objectives for drawing, permitting even higher magnification than rendered with the divisible objective.*

For reasons of the unique construction of this simplified drawing apparatus and its price being comparatively moderate, a sufficient number of these instruments may be installed in a laboratory to facilitate the students' most tedious work. One projector to every five or ten students suffices.

If it is desired to use the apparatus for ordinary projection on a screen, the entire projector with base may be removed by sliding same to the lower end of the track and lifting it out. The apparatus may thus be employed for: 1. horizontal projection; 2. vertical projection of specimens suspended in solutions and drop-slides; 3. as projection and drawing apparatus for accurate drawing of serial sections and for wax plate reconstruction.

Code Word	Cat. No.	Designation	Price
PYLMU	**25850**	**Simplified Drawing and Projection Apparatus, "SPD"**, *after Joseph M. Thuringer (Box Model)*, consisting of drawing box with vertical track attached inside, mounted thereto, optical bench with lamp housing containing lamp bulb 6-volt, 50 C.P., in centering socket, light screen with condenser, object stage, objective holder with worm gear for focusing, double divisible objective, adapter for using standard micro objectives	$
PYLOR	**25852**	**Simplified Drawing and Projection Apparatus,, "SPD"**, *after Joseph M. Thuringer (Stand-Model)*, **without box,** consisting of vertical track mounted to drawing surface, optical bench with lamp housing containing lamp bulb 6-volt, 50 C.P., in centering socket, light screen with condenser, object stage, objective holder with worm gear for focusing, double divisible objective, adapter for using standard micro objectives, including foldable screening device to serve the exclusion of external light	
ULAMO	**25944**	**Bulb,** 6-volt, 50 C.P., extra	
REMAB	**25946**	**Rheostat, 110-volt D.C.**	
REMID	**25948**	**Rheostat, 220-volt D.C.**	
RADSH	**25949**	**Transformer, 110-volt A.C.**	
RADVY	**25951**	**Transformer, 220-volt A.C.**	
		Note: *When the projector is to be used on a standard lighting circuit, a rheostat or transformer as listed is required.*	

PROJECTION AND DRAWING APPARATUS "PD"

With the view in mind to afford laboratories the use of their own microscopes for an easy manner of drawing microscopical specimens, the model "PD" has been constructed. It consists of a heavy base with a vertical column mounted thereto. To this column is attached on a rigid clamping socket a microscope base plate for the support of the microscope. The base plate is provided with an extension arm which at its extreme end carries a clamping screw accommodating a vertical rod with lamp housing. As illuminant serves the low-voltage lamp 6-volt, 5-ampere mounted in centering socket; the tubular portion of the lamp housing is provided with an illuminating lens focusable by turning its mounting. The supporting base plate for the microscope is equipped with socket for the microscope foot to rest in, and on the opposite side with a clamp holding the microscope in an absolutely rigid position.

For drawing purposes serves a total reflecting prism to be clamped over the ocular and when utilizing the microscope in horizontal position, the prism directs the image towards the drawing table. A foldable screening device excludes external light and thereby creates sufficient contrast for drawing.

When the apparatus "PD" is to be used for projection purposes with the microscope inclined to horizontal position, the reflecting prism is removed and the rays proceed towards the screen. When it is preferred to use the microscope for projection in vertical position, it is again to be equipped with the reflecting prism to serve as medium directing the rays towards the screen.

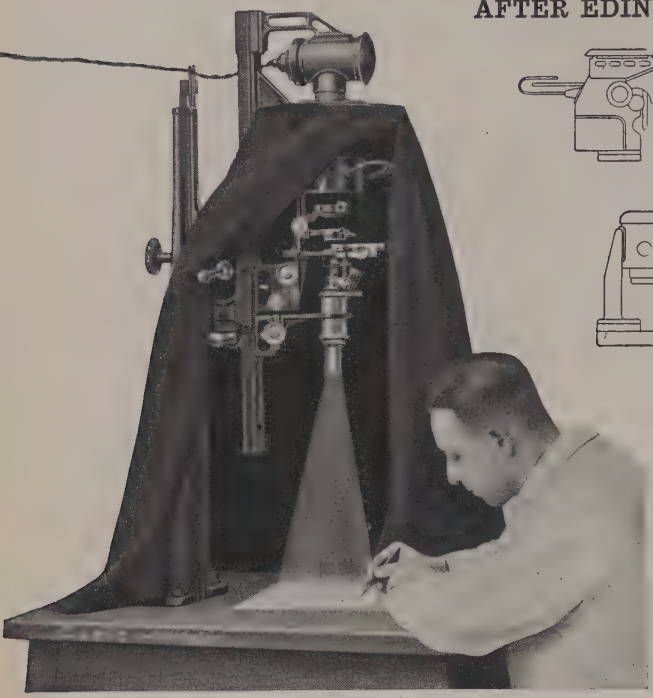
The convenient form in which the apparatus "PD" has been arranged combined with the efficient source of illumination, render the instrument very effective for drawing and projection with even high magnifications.

Since satisfactory results are greatly dependent upon the microscope being used with a correct condenser equipment, we recommend the divisible three-lens condenser N.A. 1.40 in centering mount which permits the individual lens units to be unscrewed. Utilizing the complete condenser, it is available for objectives of highest magnification; unscrewing the top lens (utilizing the middle and lower lens segments), the condenser is available for objectives of medium power (20-45X) and when using the lower lens alone, the condenser is then available for an effective illumination of objectives of low power up to 14X.

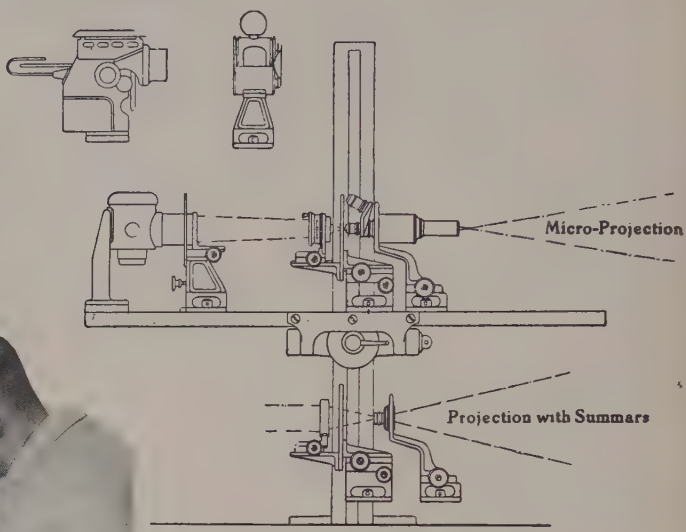
Note: If a microscope available at the laboratory is to be used with apparatus "PD" we suggest that the divisible three-lens condenser be likewise ordered. So that the latter is furnished in accurate measurements to fit the substage, the exact dimensions should be given, or preferably, the condenser of the microscope should be sent to us.

Code Word	Cat. No.	Designation	Price
POLSL	**25860**	**Drawing and Projection Apparatus "PD",** consisting of base plate with vertical column, microscope supporting plate, lamp housing with lamp bulb 6-volt, 5-ampere, foldable screen, total reflecting prism, cylinder diaphragm for drawing with objectives of low magnification	$
UAMENYLO	**25862**	**Screening Disc,** required when apparatus "PD" is being used for projection on screen	
UAMANOTE	**25864**	**Divisible Three-Lens Condenser,** N.A. 1.40, in centering mount, **without** iris diaphragm	
ILRIS	**25866**	**Divisible Three-Lens Condenser,** N.A. 1.40, in centering mount, **with** iris diaphragm *(Condenser No. 25864 is to be used with microscopes having a separate carrier with iris diaphragm.)* **Note:** *Dependent upon current conditions, either a rheostat or a transformer is necessary, selection of which can be made from the following:*	
REDIG	**32855**	**Rheostat,** stationary, for lamp on **110**-volt **D.C.**	
REDUK	**32860**	**Rheostat,** stationary, for lamp on **220**-volt **D.C.**	
BYSFI	**32865**	**Transformer,** stationary, for lamp on **110**-volt **A.C.**	
BYSGO	**32870**	**Transformer,** stationary, for lamp on **220**-volt **A.C.**	
LINID	**32875**	**Lamp Bulb,** 6-volt, 5-ampere	

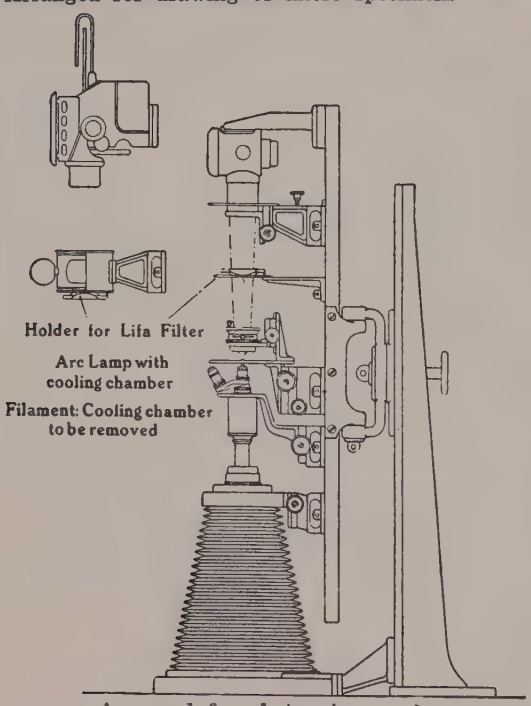
UNIVERSAL DRAWING AND PROJECTION APPARATUS "DPE" AFTER EDINGER



Arranged for drawing of micro specimens



Arranged for projection of micro specimens on screen



Arranged for photo-micrography

The apparatus "DPE" does not require any special introduction for the reason that many hundreds are in daily use throughout this country. Originally, when this instrument was offered, it represented a comparatively simple design, being accordingly restricted in its application and efficiency. Since then, practically every year the construction has been continuously improved so that today the apparatus "DPE" represents the most universal type of drawing and projection apparatus having been adopted as standard by many institutions. It is most rigidly constructed and the interchange from one mode of application to another is carried out in an exceedingly simple and unique manner. The manipulation of the apparatus is readily conceived and does not require special skill.

Much can be said to sufficiently delineate the construction and usefulness of apparatus "DPE" but in this literature we shall confine ourselves to a brief description only inasmuch as **we offer pamphlet No. 2273 in which the instrument is treated exhaustively** and this literature will be sent to those interested.

The universal mode of application of apparatus "DPE" will be readily understood when one considers that it is available for:

1. Projection and drawing of microscopical specimens under low, medium and high magnifications, when apparatus is arranged in vertical position.
2. Projection and drawing of large sections under low magnifications with wide angle objectives, when instrument is arranged in vertical position.
3. Projection on the screen of micro specimens under low, medium and high magnifications, when instrument is arranged in horizontal position.
4. Projection on the screen of large sections of micro specimens under low magnification with wide angle objectives, when instrument is arranged in horizontal position.
5. Projection of lantern slides, when apparatus is arranged in horizontal position.
6. Through the use of the special camera provided, the apparatus is readily converted for most satisfactory use in photo-micrography.
7. The apparatus is very efficient for wax plate reconstruction work.

(Continued on page 255)

Universal Drawing and Projection Apparatus "DPE"—(Continued)

The optical bench carrying the various projection units is mounted to the vertical pillar by means of a strong joint. This joint allows an immediate change from vertical to horizontal position or vice versa. A counter-poised weight holds the optical bench in place at any height desired.

The apparatus listed under Nos. 37000-37002 are available for **the projection and drawing of microscope specimens if instrument is arranged either horizontally or vertically.**

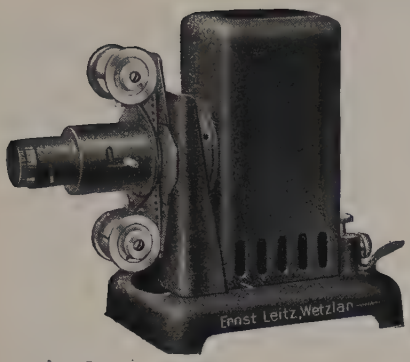
Code Word	Cat. No.	Designation	Price
EDIZE	**37000**	**Drawing and Projection Apparatus "DPE",** after *Edinger,* consisting of wooden table with drawer, vertical column with optical bench, the latter counter-balanced by weight and supplied with swivel joint for change from vertical to horizontal position or vice versa; **special low-voltage lamp 6-volt, 5-ampere, in housing,** including two lamp bulbs, rider with collimator illuminating lens; rider with holder for light filters (without filters); rider with object stage, attached thereto rack and pinion for coarse adjustment and micrometer screw for fine focus, the stage provided with substage carrier having rack and pinion for focusing the condenser; spectacle lens condenser for use with objectives 3.2X and 6X as well as "Micro-Summars" 24 and 35mm; illuminating lens on holder for use with "Summars" 42, 64 and 80mm; divisible three-lens condenser N.A. 1.40 with iris diaphragm and "Azimuth" diaphragm for oblique illumination; rider with projection microscope supplied with triple dustproof nosepiece and separate rack and pinion for coarse focus; slider with intermediate collar for "Summar" objectives; folding light screen	$
EDORN	**37002**	**Drawing and Projection Apparatus "DPE"** after *Edinger,* same as No. 37000, but equipped with **new model automatic-feed arclamp** 5-8 amperes in place of low-voltage lamp, as well as rider with cooling chamber and filter holder in place of rider with filter holder	
		The full series of micro objectives (*listed on pages 16-17*) is available for use with the apparatus "DPE" while in respect to the oculars (*listed on page 18*), we recommend only those of low and medium power. As a suitable selection of objectives and oculars, we suggest the following assortment:	
ACUBE	**22002**	**Achromatic Objective** (*Dry*), **3.2X** (40mm), N.A. 0.12	$
ACEDU	**22006**	**Achromatic Objective** (*Dry*), **6X** (24mm), N.A. 0.20	
ACODO	**22010**	**Achromatic Objective** (*Dry*), **14X** (13mm), N.A. 0.40	
FLUCA	**22024**	**Fluorite Objective** (*Dry*), **42X** (4.2mm), N.A. 0.85	
OILIM	**22022**	**Achromatic Objective** (*Oil Immersion*), **100X** (1.8mm), N.A. 1.30	
HYKUL	**22038**	"*Huyghenian*" **Ocular, 4X**	
HYZWA	**22042**	"*Huyghenian*" **Ocular, 6X**	
PERIV	**22065**	"*Periplan*" **Ocular, 4X**	
PEROT	**22069**	"*Periplan*" **Ocular, 8X**	
EDOBE	**37004**	**Complete Assortment of Objectives and Oculars listed above:** As objectives for use with large specimens without ocular, we recommend selection from the following:	
SUMAN	**28238**	**"Micro-Summar,"** 24mm, with iris diaphragm (*for specimens up to* **12***mm* diameter)	
SUMEX	**28240**	**"Micro-Summar,"** 35mm, with iris diaphragm (*for specimens up to* **18***mm* diameter)	
SUMIT	**28245**	**"Micro-Summar,"** 42mm, with iris diaphragm (*for specimens up to* **24***mm* diameter)	
SUMOS	**28247**	**"Summar,"** 64mm, with iris diaphragm (*for specimens up to* **32***mm diam.*)	
SUMUR	**28250**	**"Summar,"** 80mm, with iris diaphragm (*for specimens up to* **46***mm diam.*)	
		Note: *The "Micro-Summars" 24 and 35mm should be used in conjunction with the spectacle lens condenser while "Micro-Summar" 42mm and the "Summars" 64 and 80mm require the special illuminating lens. (Both condenser units are included in equipments Nos. 37000 and 37002.)*	

(*Continued on page 256*)

Universal Drawing and Projection Apparatus "DPE"—(Continued)

Code Word	Cat. No.	Designation	Price
			$
		Accessories for Photo-Micrography to be used with either Equipment No. 37000 or 37002:	
EDGRA	**37006**	**Camera,** for plates 8x10", with time and instantaneous shutter, two plate holders with reducing kits for smaller sizes to 3¼x4¼", focusing screen, riders for attachment of the camera to the vertical pillar.....	
		Accessories for Photographing Large Opaque Objects Supported by the Drawing Table:	
EDPAK	**37008**	**Attachment,** consisting of rail with revolving fitting, additional saddle stand for the camera, ground glass focusing screen and focusing magnifier	
		Accessories for Photographing Large Opaque Objects by means of which the Apparatus may be Converted into a General Studio Camera:	
EDTIN	**37010**	**Arrangement** after *Martin,* consisting of a double extension arm by means of which the camera is carried at a distance from the vertical pillar, including ground glass focusing screen.....	
		Note: *Equipment No. 37010 serves as an auxiliary arrangement to equipment No. 37008.*	
		Accessories for Lantern Slide Projection to be used with either Equipment No. 37000 or 37002:	
EDDIO	**37012**	**Rider,** with two-lens condenser, lantern slide changer and anastigmatic projection objective F=120mm.....	
		Note: *When ordering No. 37012 for use with equipment No. 37000 the item listed under No. 37014 is likewise required.*	
EDHIL	**37014**	**Auxiliary Lens,** for insertion into the mounting of the low-voltage lamp housing.....	
		*For the **special low-voltage lamp** included in equipment No. 37000, either of the following accessories, dependent upon the current conditions, is required:*	
REDIG	**32855**	**Rheostat,** stationary, for lamp on **110**-volt **D.C.**.....	
REDUK	**32860**	**Rheostat,** stationary, for lamp on **220**-volt **D.C.**.....	
BYSFI	**32865**	**Transformer,** stationary, for lamp on **110**-volt **A.C.**.....	
BYSGO	**32870**	**Transformer,** stationary, for lamp on **220**-volt **A.C.**.....	
LINID	**32875**	**Lamp Bulb,** 6-volt, 5-ampere, extra.....	
		*For the **new model automatic-feed** arclamp included in equipment No. 37002, either of the following accessories, dependent upon the current conditions, is required:*	
RACTU	**32665**	**Rheostat, 110**-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**).....	
RACUP	**32670**	**Rheostat, 220**-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**).....	
RACVR	**32675**	**Carbon,** 250x5mm (horizontal) for **D.C.**.....per ten	
RACWO	**32680**	**Carbon,** 120x6mm (vertical) for **D.C.**.....per ten	
RACYX	**32685**	**Carbon,** 250x4.5mm (horizontal) for **A.C.**.....per ten	
RACZY	**32690**	**Carbon,** 120x7mm (vertical) for **A.C.**.....per ten	
		General Accessories for the Universal Drawing and Projection Apparatus "DPE":	
EDIMA	**37016**	**Reversing Prism,** for obtaining erected images when drawing.....	
EDEUZ	**37018**	**Compound Mechanical Stage,** for attaching to the object stage	
DECME	**22658**	**Stage Micrometer,** 1mm divided in 100 parts.....	
EDVOR	**37020**	**Darkening Screen** (cloth curtain), for projection, when apparatus is arranged in horizontal position.....	
IFBLA	**32822**	*"Lifa"* **Filter,** *blue,* Grade No. 201a.....	
IFGRU	**32824**	*"Lifa"* **Filter,** *green,* Grade No. 201b.....	
IFROT	**32826**	*"Lifa"* **Filter,** *red,* Grade No. 201c.....	

FILM-SLIDE PROJECTOR "ULEJA"



This apparatus has been designed for the projection of "still pictures" on standard width cinema film.

The resulting economy and convenience make it highly desirable to project individual pictures on standard cinema film utilizing them for educational, commercial, as well as entertainment purposes. The use of film strips requires a specially designed projecting apparatus and the one we offer for this purpose is described in the following.

The "Uleja" film-slide projector cannot fail to greatly enhance the pleasure derived by projecting films of interesting scenes and sporting events to an audience of friends or within the family circle.

The "Uleja" serves to **particular advantage for lecture purposes** in demonstrating to students valuable and interesting material from excursions or expeditions. **Enough film for a complete lecture can be carried in the vest pocket,** while previously an equivalent quantity of lantern slides was a cumbersome task to transport, not to mention the bulky apparatus formerly employed for projection purposes.

As guide to the size of the projected image at various screen distances, may serve the following table:

Apparatus at distance of **10 ft.** from screen renders screen image of **2¼ ft.,**
Apparatus at distance of **15 ft.** from screen renders screen image of **3½ ft.,**
Apparatus at distance of **20 ft.** from screen renders screen image of **4¾ ft.,**
Apparatus at distance of **25 ft.** from screen renders screen image of **6¼ ft.,**
Apparatus at distance of **30 ft.** from screen renders screen image of **7¾ ft.,**
Apparatus at distance of **35 ft.** from screen renders screen image of **9¼ ft.**

The "Uleja" film-slide projector consists essentially of a lamp housing provided with suitable bulb. The housing is well ventilated to obviate over-heating of the film, and carries a three-lens condensing system 54mm diameter, of perfect optical correction.

The film window, two film spools and the lens tube with objective are attached to a vertical support separate from the housing. **The fact that the front support is mounted independently of the lamp housing precludes heat being transmitted from the housing to the film carrier, so that the film is scarcely liable to become warm.**

The film travels between two glass plates where it is kept flat under spring pressure. The latter acts upon one of the two glass plates which is thus rendered resilient, and may be put in and out of operation with the aid of a stud on the objective socket. It is necessary to disengage the pressure when inserting the film strip. The glass plate facing the lamp acts as a film window and is mounted to a detachable slider, which **is interchangeable with another slider (film window) having an aperture of 24 x 36mm (1 x 1⅜ in.), and used when film strips exposed with our "Leica" camera are to be projected.**

Projection Objective—80mm focal length, consists of a three-lens unit and is of high optical correction. It produces a brilliant picture, free from distortion and color defects.

Projection Lamp—Is of tubular design, 200-watt, 110-volt. It can be connected without rheostat or transformer to any standard light circuit. Only when the current supply is 220-volt, a rheostat is to be interposed since the lamp is adjusted for 110-volt. The lamp is mounted to an adjustable carrier permitting accurate centering of the light rays relative to the objective. When centered, the lamp carrier is rigidly locked in place by means of a clamping screw.

The objective with film track and spools are rotatable to permit projection of pictures in vertical or horizontal position.

With the ever-increasing use of film strips for projection in preference to lantern-slides, **the desire has made itself evident to permit the taking of pictures on standard cinema film without it being necessary to use a bulky and cumbersome camera. For this purpose we recommend the**

Leitz Pocket Roll Film Camera "Leica."

This camera is in extensive use and adapted in a most ideal manner for the preparation of lecture films. We furthermore offer a printing apparatus which transfers negative films into positive film strips for projection.

The "Leica" camera referred to is listed on pages 280-282.

Code Word	Cat. No.	Designation	Price
GNOME	**25600**	**Film Projector "Uleja,"** as described, **with film window for standard cinema picture size** ¾x1 in., with lamp 200-watt, 110-volt, complete with cord and plug **Note:** *No rheostat is required for 110-volt current.*	$
RADHI	**25646**	**Rheostat,** for above when used on 220-volt circuit	
JAGIS	**25602**	**Film Window,** interchangeable with the one supplied with No. 25600, so that the apparatus is likewise available **for use with film strips carrying pictures taken with the "Leica" camera,** size 1x1⅜in. (24x36mm)	
ELRUK	**25652**	**Lamp Bulb,** 200-watt, 110-volt	
ELRYN	**25604**	**Carrying Case,** for apparatus No. 25600, with film case for 15 rolls	

Pages 259 to 267 cover

COMBINATION PROJECTORS

For Opaque Objects, Lantern Slides, Film Slides and Micro-Slides

VISUAL INSTRUCTION

Of late much more importance is attached to visual education than prevailed in former years. It is worth remembering that the general principles of visual instruction date back more than 300 years to the credit of Comenius as mentioned in his "Orbis Pictus."

In our present day, pictures by means of optical projection occupy a very important position for instruction and entertainment. Through this method it is possible to direct the attention of every single member of a class or audience to the same object at the same time and furthermore, ample opportunity for discussion presents itself.

Since the apparatus here listed are for "still" projection, we consider it worth while to emphasize the fact that "still" pictures can be studied or enjoyed without time limitations whereas the individual pictures of a "movie film" yield only a fleeting glimpse. **Our instruments are, therefore, of special importance in lectures.**

Lantern slides can quickly be made of any subject at comparatively small cost or they can be rented from Visual Education Bureaus as well as commercial firms without charge or at nominal rates. In addition to lantern slide projection, our apparatus permit the projection of opaque objects such as books, photographs, cards, maps, biological specimens, models, etc. Attachments are offered at the same time for the projection of film slides, micro specimens and physical phenomena.

The advantages of visual demonstrations are readily appreciated by schools, colleges, Sunday schools, churches, clubs, Y. M. C. A.'s and in homes. Educators and lecturers consider an appeal to the mind by way of the eye of such importance and value that no institution can regard itself fully equipped unless it is provided with a projection apparatus of satisfactory quality.

COMBINATION PROJECTOR "Vc"

The projector "Vc" is recommended as an essential lecture equipment for educational institutions. It is in large demand by societies, congregations and industrial firms to elaborate lectures with lantern slides, travelling scenes, manufacturing methods, etc., or to project objects of non-transparent character such as photographs, post cards, maps, books, instruments and parts, relics, coins, etc.

A 500-watt, gas-filled "Mazda" lamp serves as source of light and **due to the perfection of all optical units and special reflection devices, provides ample illumination for the projection of opaque objects up to six inches in diameter for distances up to 45 feet.** (*Projectors of other manufacture must resort to a lamp of about twice the wattage as we employ, in order to obtain sufficient light, with the resulting drawback of excessive heat, endangering the projection material and waste in electric energy.*)

Objects larger than 6 x 6 in., and up to 16 in. can be placed upon the supporting plate beneath the housing and shifted to any required position, thus permitting the projection of any portion as may be desired. Since the support for opaque objects is provided with spring and lever whereby books, etc., are automatically pressed firmly against the housing and yield a plane surface, images on the screen appear flat and not curved. Frames are provided to hold pictures, photographs, etc., permitting a quick change from one to another.

By merely turning a lever handle, the change from opaque projection to lantern slides, or vice versa, is instantly accomplished, and requires no change in the position of the lamp.

The objectives are of special optical correction and perfected in such manner that the *projected image is completely flat to the utmost periphery and yields a crisp definition under a maximum amount of brilliancy.*

The lantern slide changer is of improved pattern, each lantern slide snapping into position and when inserting a new one, the former removes automatically. It is concluded that the best results are obtained in projecting opaque objects and lantern slides when not overstepping an image of 10 ft. square at the screen. The brilliancy of the image is also dependent upon the quality of the screen. For opaque projection we recommend aluminum-coated screens.

The projector "Vc" is furnished in two sizes: one equipped with objective 400mm for opaque objects and objective 250mm for lantern slides, **for screen distances of 20 to 35 ft.**; the other is equipped with objective 500mm for opaque objects and objective 350mm for lantern slides, **for screen distances of 30 to 45 ft.**

Dimensions and Weight of Projector "Vc": Extreme length = 36 in. x 10.5 in. wide x 18.5 in. extreme height; weight 34 lbs.

Projection in Daylight—"Daylight Projection" refers to projecting pictures in a room that is fully or partially lighted. It has to be conceded that it is desirable to avoid the closing of windows and total darkening of rooms with the attending result to preclude proper ventilation and sufficient light for taking notes and maintaining discipline.

Using a special screen of translucent fabric and placing the apparatus in sufficient close proximation to the screen (the screen being situated between audience and projector) it is possible to project pictures in broad daylight. With this mode of projection, care has to be exercised that no direct rays from a powerful electric lamp or sunlight fall on the screen or objective, since this would

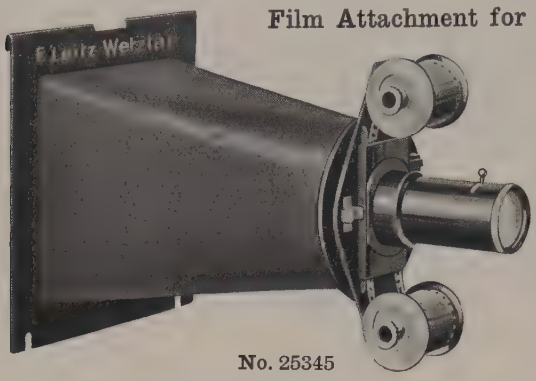
(*Continued on page 260*)

Combination Projector "Vc"—(Continued)

impair satisfactory results. In addition, it has to be considered that a smaller picture is obtained to offset the illumination of the room.

Our apparatus "Vc" is primarily constructed for use with opaque screens, therefore, when using them on translucent screens, the pictures appear as mirror images, in other words, reversed. To project on daylight screens in an erected manner, mirror appliances are required. For this reason we furnish for projector "Vc" two single reversing mirrors with clamping rings, one of which fits over the objective for opaque projection and the other over the objective for lantern slide projection.

Film Attachment for Apparatus "Vc"



No. 25345

To project individual pictures printed on standard motion picture film, it is necessary to resort to specially designed projection apparatus such as listed on page 257. By means of the film holder No. 25345, the projector "Vc" is likewise available for the projection of "still" pictures on motion picture film. This holder can be attached after the lantern slide adapter is removed.

The two film spools with film track and window are mounted to a hinged base plate. The film is placed upon the upper spool, the one end passing through the track, to be clamped upon the lower spool. This accomplished, the objective with socket-plate is moved into position. Both film spools are provided with knurled knobs for moving the film, to effect a change from one picture to another. The film may be run backwards to refer to a preceding picture. Through proper tension, automatically applied, the film is always held flat to prevent buckling.

The objective with film track and spools are rotatable to permit projection of pictures in their horizontal or vertical position.

Micro-Projection Attachment for Apparatus "Vc"

No. 25360

In order to offer the projector "Vc" for a still further range of usefulness, we have constructed a micro-projection attachment, consisting of an optical bed, mounted thereon an object stage with two clips and an adjustable objective carrier. This arrangement is supported by a cone-shaped metal adapter and mounted within its front window is a suitable illuminating lens. The cone-shaped adapter is provided with a hinged locking device by which it is fastened to the projector housing, in place of the lantern slide attachment, after the latter has been removed.

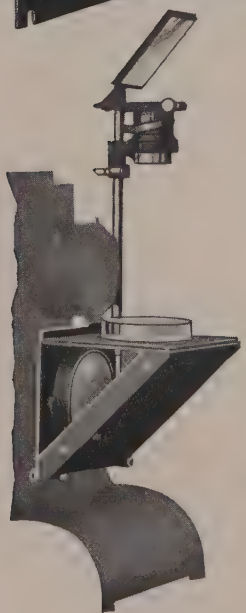
Standard micro objectives of 40mm **(3.2X)** and 24mm **(6X)** are recommended for use with this projection attachment and yield the following magnifications at a screen distance of 12 ft.:

Objective 40mm, about 100X,

Objective 24mm, about 200X,

and at larger or shorter screen distances proportionately higher or lower magnifications prevail.

The objectives are screwed to the holder, the latter affords a precise coarse, as well as fine focus. **The brilliancy of the micro image is surprising and the definition very crisp, the field at the same time being remarkably flat.**



No. 25363

Vertical "Dia-Attachment" for Apparatus "Vc"

This device is likewise so arranged that it can be interchangeably attached in place of the lantern slide projection arrangement. The "Dia-Attachment" is provided with a mirror system whereby it is possible to orient transparent objects in a horizontal position and to project them in this manner, viz., solutions in glass dishes, experiments for the demonstration of electrical as well as magnetic fields, Chladni's sound-figures, curves of tuning fork vibrations, demonstration of crystallizing phenomena, surface-tension of cohesion figures, etc. Through this attachment the versatility of the Leitz projector "Vc" for use in schools has been advanced to a marked degree and its universal application is widely appreciated.

(*Continued on page 261*)

Combination Projector "Vc"—(Continued)

Tables of Picture-Size at the Screen at Various Distances

Table I: For Lantern Slides, 2¾ x 3 in. clear opening:

Objective, Focal Length	Distance from Apparatus to Screen							
	10 ft.	**15 ft.**	**20 ft.**	**25 ft.**	**30 ft.**	**35 ft.**	**40 ft.**	**45 ft.**
200mm	4 ft.	5½ ft.	7½ ft.	9½ ft.	11 ft.	13 ft.	15 ft.	.....
250mm	3 ft.	4½ ft.	6 ft.	7½ ft.	9 ft.	10½ ft.	12 ft.	13½ ft.
350mm	....	.....	4 ft.	5 ft.	6 ft.	7 ft.	8 ft.	9 ft.

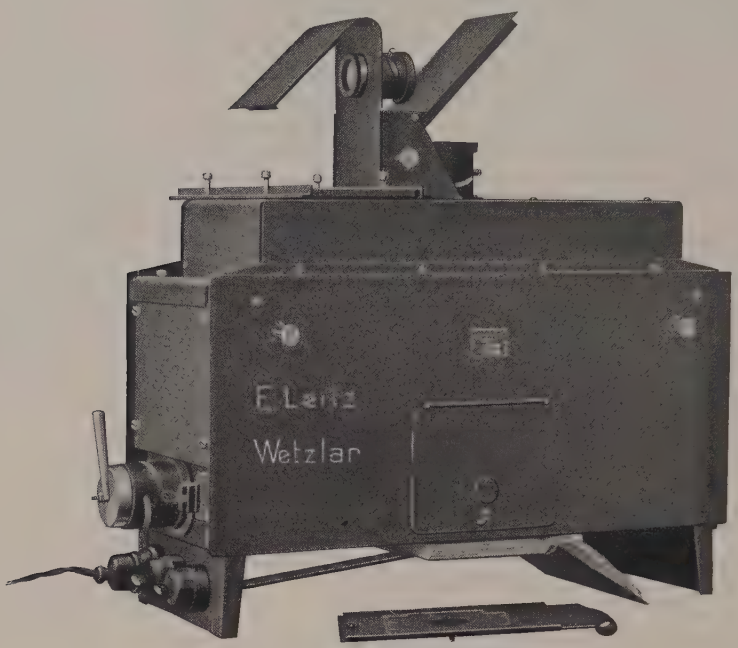
Table II: For Opaque Objects, 6 x 6 in.:

Objective, Focal Length	Distance from Apparatus to Screen						
	15 ft.	**20 ft.**	**25 ft.**	**30 ft.**	**35 ft.**	**40 ft.**	**45 ft.**
325mm	6 ft.	8 ft.	10 ft.	.....	.....	.....	.....
400mm	5 ft.	7 ft.	8½ ft.	10 ft.	12 ft.	.....	.....
500mm	...	5 ft.	6½ ft.	8 ft.	9 ft.	10½ ft.	12 ft.

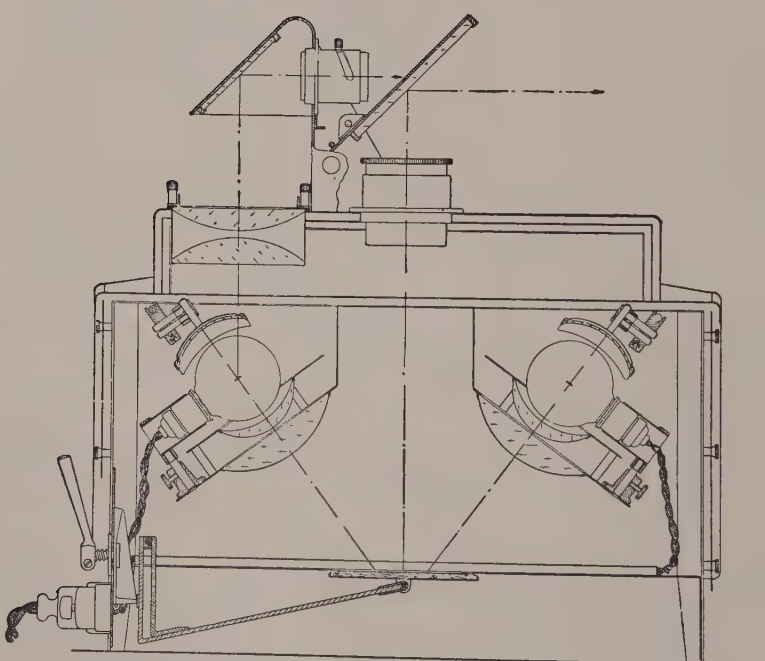
Code Word	Cat. No.	Designation	Price
ULCUT	**25300**	**Combination Projector "Vc",** for **screen distances of 20-35 ft.,** complete as described on pages 259-260, arranged for the projection of **lantern slides** (objective 250mm) and **opaque objects** (objective 400mm) with special filament lamp bulb 500-watt, 110-volt, 11½ ft. cord with switch and socket.....	$
ULCEP	**25305**	**Combination Projector "Vc",** same as No. 25300, but **for projection of opaque objects only**.....	
UCANS	**25307**	**Lantern Slide Arrangement,** for **"Vc",** which can be ordered at any later time, for apparatus No. 25305.....	
UCEPA	**25309**	**Combination Projector "Vc",** for **screen distances of 30-45 ft.,** complete as described on pages 259-260 arranged for the projection of **lantern slides** (objective 350mm) and **opaque objects** (objective 500mm) with special filament lamp bulb 500-watt, 110-volt, 11½ ft. cord with switch and socket..... **Note:** *For current 110-115 volt no rheostat is required and the cord can be directly connected to a lamp socket.*	
REAMO	**25320**	**Rheostat,** for **220**-volt **D.C.**.....	
REAFU	**25321**	**Transformer,** for **220**-volt **A.C.**..... **Note:** *Since the lamps in the projectors are for 110-volt, the accessories No. 25320 or 25321 are to be used with 220-volt current.*	
HAPXL	**25335**	**Set of Accessories,** for projector "Vc" **in daylight projection** for translucent screens, consisting of two reversing mirrors, one for opaque and the other for lantern slide projection, complete..... **Note:** *Projector "Vc" No. 25300 with the accessories No. 25335 can be used at a* ***minimum distance of 8 ft.*** *from the translucent screen; at this distance a screen of the* ***size of at least 36x45 in.*** *is required, while at increased distances a screen of proportionately larger size is needed.*	
UFILA	**25345**	**Film Projection Attachment,** for **"Vc"** (*as described on page 260*), picture size ¾x1 in., with objective 64mm, complete.....	
JAGIS	**25602**	**Film Window only,** interchangeable with the one supplied under No. 25345, so that the attachment is likewise available for use with film strips **carrying pictures taken with the "Leica" camera, size 1x1⅜ in.**.....	
UGUYN	**25360**	**Micro-Projection Attachment** for **"Vc"** (*as described on page 260*), without objectives..... **Note:** *The following micro objectives are available for use with attachment No. 25360:*	
ACUBE	**22002**	**Achromatic Objective, 3.2X** (40mm).....	
ACEDU	**22006**	**Achromatic Objective, 6X** (24mm).....	
UDEMO	**25363**	**Vertical "Dia-Attachment"** for **"Vc"** (*as described on page 260*), for demonstration of solutions in glass dishes, including objective 200mm..... **Note:** *When ordering any of the attachments Nos. 25345, 25360, or 25363, the following condenser unit is likewise required:*	
UAKUDYAL	**25363a**	**Two-Lens Condenser Unit,** 155mm diameter, in mounting for **"Vc"**	
ULSIT	**25325**	**Wooden Table,** on four legs, adjustable, with inclinable base plate and auxiliary board for accessories.....	
ULLAM	**25330**	**Lamp Bulb,** 500-watt, for **"Vc",** extra.....	
ULIBE	**25366**	**Extra Postal Card Frames**.....**ea.**	
ULSUS	**25368**	**Hardglass Plate in Frame,** for covering sensitive opaque objects, to protect them against heat.....	
ULISA	**25370**	**Postal Card Frame** with hardglass plate; which opens automatically when removing the card.....	
ULKAS	**25372**	**Carrying Case for "Vc",** accommodating the projector and all attachments including rheostat; size of case 35 in. long x 14 in. wide x 20 in. high, complete with lock and key.....	
ULHUL	**25376**	**Cover,** of canvas, for **"Vc",** to protect the apparatus against dust	

"TWO-LAMP" OPAQUE PROJECTOR "XII"

(for distances up to 50 ft.)



Exterior View of "XII"



Cross Section of "XII" Showing Mechanical and Optical Details

(Continued on page 263)

"Two-Lamp" Epidiascope "XII"—(Continued)

This projector has been devised to render at long screen distances a brilliant image of opaque objects such as books, photographs, cards, maps, biological specimens, models, etc. With the two lamps with which the apparatus is equipped, objects are brightly illuminated and due to the faultless optic employed, the resulting image is sharp within its minutest details. **The efficiency of this apparatus has no parallel** and its advantages will be readily evident particularly for lecture rooms accommodating large audiences.

In its dimensions, the housing is so constructed as to provide ample opportunity for ventilation and cooling. For the very same reason the housing consists of a double wall resulting in a continuous flow of air passing between the walls for cool air to enter and the hot air to escape, and furthermore, the double wall arrangement serves the apparatus in not transmitting any heat to the exterior. The housing consists of strong sheet iron covered with a permanent and substantial layer of crystal lacquer.

The plane of the diapositive changer is situated horizontally, the frame being easily accessible for a quick interchange from one lantern slide to another. The horizontal position of the diapositive changer has furthermore the advantage that upon plane glass surfaces, sketches may be made during the process of projection and consequently the apparatus permits demonstrating lectures effectively. This arrangement brings with it an additional feature since the lecturer may point to spots of interest directly upon the lantern slide instead of being compelled to point with a stick at the projected image on the screen. The horizontal image stage serves effectively for the projection of visual, chemical or biological experiments. The interchange from the projection of opaque objects to the projection of lantern slides is easily and quickly accomplished through pulling out the knob at the back of the housing and in this manner the reflector situated above the back lamp is swung aside to clear the rays of the lamp to proceed vertically. In addition, the mirror situated above the objective serving opaque projection is swung downward through pulling out the knob situated at the mirror support. It is likewise recommended to disconnect the front lamp since for lantern slide projection it is not required.

The objectives in addition to their perfect optical correction are of the wide angle type and satisfy the most precise requirements in respect to brightness and depth of focus. The projector "XII" is offered with objectives of various focal lengths with the result that the instrument is available for various screen distances while at these distances the size of the projected image is always of convenient dimensions; for instance, if the apparatus is situated 20-50 ft. from the screen, the size of the image measures from 6 to 10 ft. (*correct data in this respect is given in the table below*). Diapositive projection permits the use of lantern slides up to 3¼ x 4¼ in. The effective surface in opaque projection measures 160 x 160mm or 180 x 180mm respectively, while provision is made that objects up to the width of 600mm and any desired length may be used for projection.

Two lamp bulbs each 500-watt, for direct connection to the light circuit, serve as source of illumination. In front of each lamp are situated two-lens condenser systems and an additional two-lens unit is mounted below the lantern slide changer. These lenses together with two outside silvered mirrors assure the highest degree of light intensity.

Up to a screen distance of approximately 30 ft., the various attachments, viz:

Film Projection Attachment No. 25345 (*listed on pages 260-261 in connection with Projector "Vc"*) and

Micro-Projection Attachment No. 25360 (*listed on pages 260-261 in connection with Projector "Vc"*) may be utilized.

Table of Picture Size, in feet, at the Screen at Various Distances:

Mode of Projection and Focal Length of Objectives	Distance of Projector from Screen (ft.)									
	13	**16**	**20**	**23**	**26**	**30**	**33**	**36**	**40**	**43**
Opaque Objective 400mm (*Effective Opaque Surface: 160x160mm*)	5	6	7½	8½	10	11½				
Lantern Slide Objective 250mm (3¼x4¼" Clear Opening)	6	7	8½	10	11	12½				
Opaque Objective 500mm (*Effective Opaque Surface: 180x180mm*)				7½	8½	10	11½	12½		
Lantern Slide Objective 330mm (3¼x4¼" Clear Opening)				7½	8½	10	11½	12½		
Opaque Objective 600mm (*Effective Opaque Surface: 180x180mm*)					7½	8½	9	10	11½	12½
Lantern Slide Objective 400mm (3¼x4¼" Clear Opening)					7½	8½	9	10	11½	12½

(*Continued on page 264*)

"Two-Lamp" Epidiascope "XII"—(Continued)

Weight of apparatus No. 37050: 85 lbs. without packing; 180 lbs. completely packed;
Weight of apparatus No. 37058: 95 lbs. without packing; 195 lbs. completely packed,
Weight of apparatus No. 37066: 105 lbs. without packing; 205 lbs. completely packed;
Size of apparatus: 85cm long, 44cm wide, 79cm high.

Code Word	Cat. No.	Designation	Price Unit	Price Total
UAPOLAXE	**37050**	**"Two-Lamp" Opaque Projector "XII"**—for **screen distances of 13-26 ft.**—with effective opaque surface **160x160mm**; apparatus consisting of lamp housing, with two lamp bulbs 500-watt; three two-lens condenser units 155mm diameter for lantern slides and opaque objects; lantern slide changer with frames for various sizes up to 3¼x4¼ in.; stage for opaque objects adjustable through worm gear; one each outside silvered mirror for lantern slide and opaque projection; 10 ft. cord with plug	$	
UAFUARIS	**37052**	**Objective 400mm** focal length for **opaque objects**		
UADIANDO	**37054**	**Objective 250mm** focal length for **lantern slides**		
UAPULYTO	**37056**	**Projector "XII" for screen distances 13-26 ft., complete**		$
UAPYLIDO	**37058**	**"Two-Lamp" Opaque Projector "XII"**—for **screen distances of 26-32 ft.**—with effective opaque surface **180x180mm**; apparatus consisting of lamp housing, with two lamp bulbs 500-watt; three two-lens condenser units 155mm diameter for lantern slides and opaque objects; lantern slide changer with frames for various sizes up to 3¼x4¼ in.; stage for opaque objects adjustable through worm gear; one each outside silvered mirror for lantern slide and opaque projection; 10 ft. cord with plug		
UADEPATU	**37060**	**Objective 500mm** focal length for **opaque objects**		
UARALIMI	**37062**	**Objective 330mm** focal length for **lantern slides**		
UARELIMO	**37064**	**Projector "XII" for screen distances 26-32 ft., complete**		
UARILOME	**37066**	**"Two-Lamp" Opaque Projector "XII"**—for **screen distances of 32-50 ft.**—with effective opaque surface **180x180mm**; apparatus consisting of lamp housing, with two lamp bulbs 500-watt; three two-lens condenser units 155mm diameter for lantern slides and opaque objects; lantern slide changer with frames for various sizes up to 3¼x4¼ in.; stage for opaque objects adjustable through worm gear; one each outside silvered mirror for lantern slide and opaque projection; 10 ft. cord with plug		
UADYOSUS	**37068**	**Objective 600mm** focal length for **opaque objects**		
UAFUARIS	**37070**	**Objective 400mm** focal length for **lantern slides**		
UAROLETE	**37072**	**Projector "XII" for screen distances 32-50 ft., complete**		
RADELBOX	**37074**	**Rheostat,** for use of above apparatus on **220-volt,** complete with two cords **Note:** *This rheostat is required if the available current is 220-volt so that its voltage may be reduced to 110-volt for which the lamps are available.*		
UARULYXO	**37076**	**Table,** for the support of apparatus "XII"		
ULSUS	**37078**	**Hard Glass Plate,** with frame, for opaque objects, effective size **160x160mm**		
UARYLEND	**37080**	**Hard Glass Plate,** with frame, for opaque objects, effective size **180x180mm**		
ULLAM	**37082**	**Lamp Bulb,** 500-watt, 110-volt		
UASALABO	**37084**	**Cover,** of canvas, for protecting apparatus "XII" against dust		
UASILEGE	**25345a**	**Film Projection Attachment,** for "XII" *(as illustrated and described on page 260)*		
JAGIS	**25602**	**Film Window only,** interchangeable with the one supplied under No. 25345a, so that the attachment is likewise available for use with film strips **carrying pictures taken with the "Leica" camera, size 1x1⅜ in.**		
UGUZX	**25360a**	**Micro-Projection Attachment,** for "XII" *(as described on page 260)*, without objectives **Note:** *The following micro objectives are available for use with attachment No. 25360a:*		
ACUBE	**22002**	**Achromatic Objective, 3.2X** (40mm)		
ACEDU	**22006**	**Achromatic Objective, 6X** (24mm) **Note:** *When ordering any of the attachments Nos. 25345a or 25360a, the following Adapter is likewise required:*		
UASELOST	**25363b**	**Adapter,** with illuminating arrangement, for "XII"		

LARGE EPIDIASCOPE "IIIF"

Four-Lamp Opaque Projector

(for screen distances up to 60 ft.)

The projector "IIIf" involves a complete novelty as an apparatus for opaque projection since in its construction it employs four incandescent lamps each of 500-watt. The light intensity is carried to an extreme with the result that **at long screen distances the projected image of even dark opaque objects is exceedingly brilliant.**

For large lecture rooms and projection to large audiences, the projector "IIIf" represents the most ideal equipment since in its efficiency it surpasses any apparatus so far offered.

The projector consists of a substantial housing made of sheet iron supported by four heavy legs on rollers. Ample provision has been made for thorough ventilation so as to protect the objects against over-heating. A ventilator fan continuously exhausts the heated air and its revolution is regulated through an adjustable switch; the ventilator operates practically without noise.

Four lamps, each 500 watt, serve for opaque projection; these lamps being provided with reflectors and condenser lenses. In order to serve its purpose in a most satisfactory manner, the projector "IIIf" has been arranged to provide an extra large object stage being accessible from all sides with the result that objects 3½ ft. wide and of any desired length may be placed into the apparatus for projection of illuminated surfaces from 200 x 200 to 250 x 250mm. Since four lamps illuminate the object from all sides, **the advantage results that uneven objects are brightly illuminated without shadow and consequently render a brilliant and distinct image even at long screen distances.**

The lantern slide projection is accomplished by means of a special lamp which together with its condenser lens shifts into the optical axis and directs its light towards the lantern slide changer. The frame holding the changer is so arranged that it will accommodate adapters for lantern slides of various sizes up to 3¼ x 4¼ in. and besides when withdrawing the lantern slide changer, other transparent objects such as X-ray plates or films in size up to 500 x 500mm may be used for diascopic projection.

The apparatus is built with utmost precision and its construction has been arranged in such manner that easy manipulation and furthermore a quick interchange from one mode of projection to another are chief factors.

The objectives supplied for apparatus "IIIf" are of highest optical correction, possess a great amount of focal depth and due to their increased light transmitting power render an image of unsurpassed quality. It is recommended to select in accordance with the size of the lecture room as

(Continued on page 266)

Large Epidiascope "IIIf"—(Continued)

well as the desired screen distances, objectives of proper focal length to meet the requirements in a most advantageous manner. In the following, we make suggestions as to which objectives are best suited for specific screen distances; for instance:

for screen distances 13-17 ft.: { objective 400mm for opaque objects; objective 200mm for lantern slides;
for screen distances 17-23 ft.: { objective 500mm for opaque objects; objective 250mm for lantern slides;
for screen distances 17-27 ft.: { objective 600mm for opaque objects; objective 325mm for lantern slides;
for screen distances 27-40 ft.: { objective 800mm for opaque objects; objective 400mm for lantern slides;
for screen distances 40-60 ft.: { objective 800mm for opaque objects; objective 500mm for lantern slides.

When projecting opaque objects, the object size as is faultlessly transmitted varies with the focal length of the objective as can be learned from the following:

with opaque objective **400mm**, the effective illuminated surface covered is **200 x 200mm**;
with opaque objective **500mm**, the effective illuminated surface covered is **200 x 200mm**;
with opaque objective **600mm**, the effective illuminated surface covered is **230 x 230mm**;
with opaque objective **800mm**, the effective illuminated surface covered is **250 x 250mm**.

Table of Picture Size, in feet, at the Screen at Various Distances:

Mode of Projection and Focal Length of Objectives	Distance of Projector from Screen (ft.)															
	7	10	13	16	20	23	26	30	33	36	40	43	46	50	55	60
Opaque Objective 400mm (*Effective Opaque Surface: 200x200mm*)	2½	4	6	7½	9	11	12									
Lantern Slide Objective 200mm (3¼x4¼" Clear Opening)	3½	5	7	8½	11	12½	14									
Opaque Objective 500mm (*Effective Opaque Surface: 200x200mm*)				6	7½	8½	10	11½	12½							
Lantern Slide Objective 250mm (3¼x4¼" Clear Opening)				7	8½	10	11½	13	14							
Opaque Objective 600mm (*Effective Opaque Surface: 230x230mm*)				5½	7	8	9	10½	12	13						
Lantern Slide Objective 325mm (3¼x4¼" Clear Opening)				5½	6½	7½	8½	9½	11	12						
Opaque Objective 800mm (*Effective Opaque Surface: 250x250mm*)						6½	7½	8½	9½	10½	12	13	14			
Lantern Slide Objective 400mm (3¼x4¼" Clear Opening)						6	7	8	9	10	11	12	13			
Opaque Objective 800mm (*Effective Opaque Surface: 200x200mm*)*							6	7	8	9	10	11	12	13	14	15
Lantern Slide Objective 500mm (3¼x4¼" Clear Opening)							5	6	7	8	9	10	11	12	13	14

** A diaphragm has been resorted to to restrict the opaque field to 200 x 200mm and this for the reason that otherwise, on projection distances exceeding 40 ft., the image at the screen becomes too large in size.*

(*Continued on page 267*)

Large Epidiascope "IIIf"—(Continued)

Code Word	Cat. No.	Designation	Price Unit	Price Total
UACIMARA	**37100**	**Four-Lamp Opaque Projector "IIIf"**—for **screen distances 13-17 ft.**—with effective opaque surface **200x200mm**; consisting of projector housing, mounted to four iron legs, including four lamp bulbs each 500-watt, **110-volt,** with condensers and reflectors; special lamp for lantern slide projection, with condenser; fan ventilator, including adjustable switch; large object stage 500x600mm, with worm gear arrangement for raising and lowering; attachment with lantern slide changer, and frames for use of lantern slides up to 3¼x4¼ in.; 10 ft. cord, with two plugs	$	$
UATOMBRA	**37102**	**Objective 400mm** focal length, 1:4.5, for **opaque objects**		
UACUYARA	**37104**	**Objective 200mm** focal length, for **lantern slides**		
UAWOYADE	**37106**	**Projector "IIIf" for screen distances 13-17 ft., complete:**		
UADAWETE	**37108**	**Four-Lamp Opaque Projector "IIIf"**, same as No. 37100, but for **screen distances 17-23 ft.**—with effective opaque surface **200x200mm**		
UADETAPU	**37110**	**Objective 500mm** focal length, 1:4.5, for **opaque objects**		
UADIANDO	**37112**	**Objective 250mm** focal length, for **lantern slides**		
UADOIMOS	**37114**	**Projector "IIIf" for screen distances 17-23 ft., complete:**		
UADUFESA	**37116**	**Four-Lamp Opaque Projector "IIIf"**, same as No. 37100, but for **screen distances 17-27 ft.**—with effective opaque surface **230x230mm**		
UADYOSUS	**37118**	**Objective 600mm** focal length, 1:4.5, for **opaque objects**		
UAFABERI	**37120**	**Objective 325mm** focal length, for **lantern slides**		
UAFEMENS	**37122**	**Projector "IIIf" for screen distances 17-27 ft., complete:**		
UAFIVANO	**37124**	**Four-Lamp Opaque Projector "IIIf"**, same as No. 37100, but for **screen distances 27-40 ft.**—with effective opaque surface **250x250mm**		
UAFORICO	**37126**	**Objective 800mm** focal length, 1:4.8, for **opaque objects**		
UAFUARIS	**37128**	**Objective 400mm** focal length, for **lantern slides**		
UAFYLARE	**37130**	**Projector "IIIf" for screen distances 27-40 ft., complete:**		
UAGANERO	**37132**	**Four-Lamp Opaque Projector "IIIf"**, same as No. 37100, but for **screen distances 40-60 ft.**—with effective opaque surface **200x200mm**		
UAFORICO	**37126**	**Objective 800mm** focal length, 1:4.8, for **opaque objects**		
UADETAPU	**37134**	**Objective 500mm** focal length, for **lantern slides**		
UAGIASSE	**37136**	**Projector "IIIf" for screen distances 40-60 ft., complete:**		
UAGOASTI	**37138**	**Rheostat,** for use of above apparatus on **220-volt,** complete, with cords **Note:** *This rheostat is required if the available current is 220-volt so that this voltage may be reduced to 110-volt for which the lamps are available.*		
UATYESON	**37140**	**Switchboard,** for apparatus "IIIf", when used on **220-volt, additional** **Note:** *The switchboard for apparatus "IIIf" when used on 110-volt is included in the above equipments; No. 37140 simply represents the price for a switchboard to be operated on 220-volt.*		
ULLAM	**37082**	**Lamp Bulb,** 500-watt, 110-volt		
UATABILO	**37142**	**Cover,** of canvas, for protecting apparatus "IIIf" against dust		

Pages 269 to 278 cover

PROJECTION APPARATUS

For Special Purposes

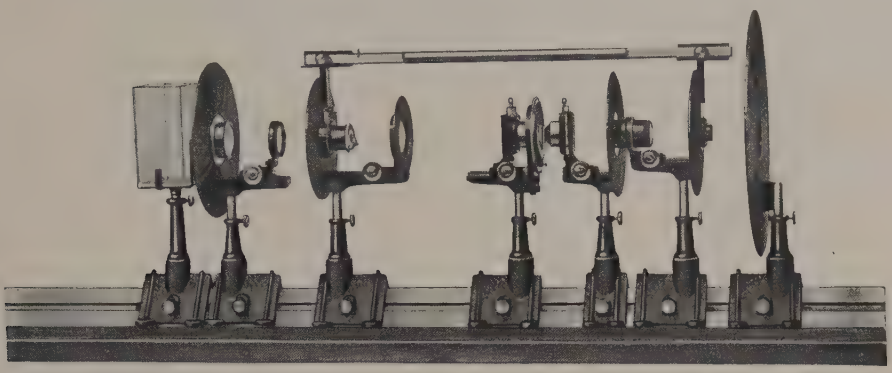
In the aforegoing pages we have described projection and drawing apparatus for micro specimens, film slide projectors and apparatus for the projection of opaque specimens as well as lantern slides. These various groups of instruments do not by any means constitute the entire series of projection apparatus we offer and the field would not have been covered completely without placing at the disposal of the scientific profession, projection equipments to meet special existing requirements, such as apparatus for the projection of physical phenomena, separate apparatus for the projection of micro specimens (mineral slides) in polarized light, and instruments for the projection of spectral images. Equipments of this kind are described on pages 269 to 278.

These apparatus are of eminent importance for lecture work and teaching to students since through their use, lectures can be made much more instructive and optical phenomena may be illustrated which otherwise would not be at all possible or in many instances only through the student making individual use of a polarizing microscope. Realizing on the other hand that hardly in any laboratory a sufficient number of polarizing microscopes is available so as to have one definite instrument consigned to each student, the teaching of optical phenomena by this means is very tedious and impracticable.

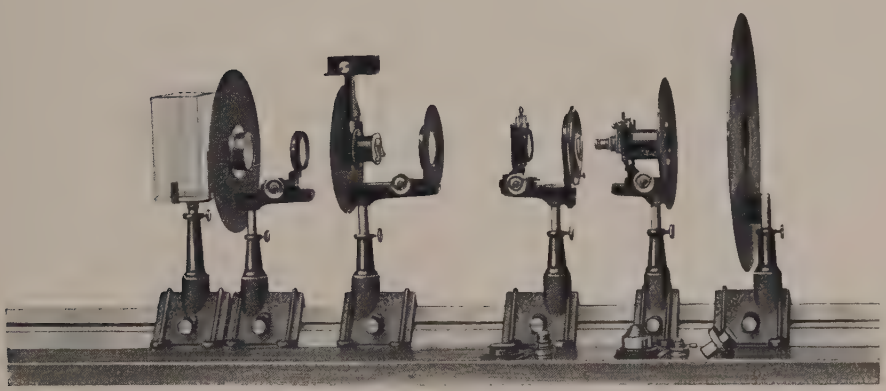
Our belief, therefore, is well founded and justified that the projection apparatus for special purposes are destined to create an ever-increasing necessity amongst the teaching profession just as soon as the importance of the use of these instruments is sufficiently recognized.

PROJECTOR "MPS"—UNIVERSAL MODEL

I: For the projection of the reaction of crystal optics under polarized light;
II: For the projection of visual phenomena;
III: For the projection of spectral analysis.



Apparatus "MPS" arranged for the projection of interference figures with thick preparations in convergent light



Apparatus "MPS" arranged for micro projection in polarized light

The projector "MPS" consists essentially of a base board with triangular optical bench 140cm long on which are mounted multiple units of riders supporting microscope parts, illuminating devices and other accessories required for the one or other mode of projection for which the instrument is to be used. From this it follows that in addition to

1) The base board with triangular optical bench,
2) The automatic-feed arclamp on rider, and
3) The hard glass collimator illuminating unit with screen disc on rider,

multiple units on riders have to be made available to successfully permit carrying out any and all of those different modes of projection to which the instrument is to be made applicable.

A: Projection of the reaction of crystal optics under polarized light:

This method can well be subdivided in three groups, such as

1. Orthoscopic (surface structure) projection,
2. Conoscopic (interference figure) projection, and
3. Micro-projection.

(Continued on page 270)

Projector "MPS"—(Continued)

For all three modes of projection (referred to under A-1, 2 and 3), the following accessories are required (*the numbers enumerated represent those inserted above the illustrations on page 269*):

Base plate with triangular optical bench 140cm long,
Automatic-feed arclamp on rider,
Hard glass collimator illuminating system with screening disc on rider,
Rider "1" with large cooling cell (to be placed close to the collimator illuminating system),
Rider "2" with two-lens collector unit; the negative lens unit focusable by rack and pinion (this rider is to be placed close to the cooling cell),
Rider "3" with polarizer (is to be placed at the mark "P" noted on the triangular optical bench),
Rider "4" with object stage (is to be placed at the mark "T" noted on the triangular optical bench).

Note: *The various accessories mentioned above are to remain oriented within the very same positions during the three different modes of projection referred to.*

For the individual groups of projection, the following additional units are required:

1. **Orthoscopic (surface structure) projection;** for projecting the reaction of crystal optics under polarized light:

   Rider "5" with projection objective and analyzer; the coarse focus of the preparation is obtained through shifting of the rider, and the fine focus by means of rack and pinion.

2. **Conoscopic (interference figure) projection** (*see illustration on page 269*) under polarized light:

   Two-lens condenser with centering adapter mounted to slider;

   Rider "6" with special condenser (to be placed between rider "4" with object stage and rider "5" with objective and analyzer).

3. **Micro-projection under polarized light** (*see illustration on page 269*):

   After the rider "5" for surface projection is removed from the optical bench and the special condenser is withdrawn from rider "6," the latter is replaced by a microscope tube; the spectacle condenser is to be inserted into the focusable bracket of rider "4" equipped with object stage; when projecting interference figures, an auxiliary lens is to be attached to the tube.

   The cone of light is made to converge to a narrow pencil where it traverses the *"Nicol"* prisms and consequently it is possible to utilize prisms of comparatively small diameter.

Note: We have prepared a carefully selected collection of 33 different preparations which is to serve as an excellent medium for the demonstration of all important phenomena in the field of crystal optics; this collection is supplied with a manual containing detailed directions for the application of the preparations to the various methods of demonstration.
If interested, write for booklet Pol. No. 2039.

B: Projection of physical phenomena:

Likewise for this mode of projection, the base plate with triangular optical bench 140cm, the automatic-feed arclamp on rider and the hard glass collimator illuminating unit with screening disc on riders are required as essential units and then again depending upon the extent of the demonstrations of physical phenomena, a more or less complete assortment of riders is required, so arranged, that by means of their saddles, they can be locked in place at the triangular optical bench and permitting adjustment to height. In every case it is essential to utilize rider "1" with cooling cell, the latter, dependent upon its position, can be made to furnish for the light rays a cooling surface of either 170 or 70mm deep. The light emerges through the interchangeable round glass windows of 32mm. The equipment includes two iris diaphragms (one permitting an aperture from 3-70mm and the other from 2-28mm), and one revolving disc diaphragm with ten apertures varying from 1-10mm diameter. Any of the following accessories can likewise be supplied: horizontal stage on rider; water troughs of various size; condensers of various focal lengths; centering adapters for lenses of different size; *"Leybold's"* trough of fairly large dimensions; two filter holders, one for several filters to be mounted successively and one for three *"Lifa"* filters to be used interchangeably.

Note: *A representative assortment of accessories for physical phenomena is listed in the columns on page 272.*

(*Continued on page 271*)

Projector "MPS"—(Continued)

C: Projection of spectral analysis:

For the demonstration of spectral analysis, the apparatus can be supplied with a very practical arrangement; for instance, a lens held within a screening disc of large diameter mounted to rider converts the light cone of the small condenser into a convergent pencil; a second rider supports a small optical bench and to the latter is mounted a precision slit adjustable to height and width as well as turnable to its axis, a focusable lens which creates the slit image and an interchangeable prism. Utilizing the base plate with triangular optical bench mounted thereto the automatic-feed arclamp and adding the items described in the aforegoing, a most brilliant image of the spectrum, approximately six to seven feet long, may be projected on the screen.

Code Word	Cat. No.	Designation	Price Unit	Price Total
		A: Essential Parts of Model "MPS" required for all modes of projection:	$	$
PONOM	**37160**	**Base Plate,** heavy, wood, with triangular optical bench 140cm long		
PONUP	**37162**	**Arclamp,** automatic-feed, with clockwork mechanism, new model, 5-8 ampere; on rider		
PONIX	**37164**	**Hard Glass Collimator Illuminating System,** with screen disc, on rider		
PONYT	**37166**	**Total Equipment A:**		
		B: General Accessories for projection in polarized light:		
PHLYR	**37168**	**Cooling Cell,** 150x170x170mm; mounted to **rider "1"**		
PHLEK	**37170**	**Two-Lens Collection System,** negative lens of which is focusable by rack and pinion; mounted to **rider "2"**		
PHLAT	**37172**	**Polarizer,** 36x12mm, mounted stationarily,with collimator lens adjustable by rack and pinion; mounted to **rider "3"**		
PHLUZ	**37174**	**Object Stage,** rotatable, with sleeve for the accommodation of condensers, without condensers; mounted to **rider "4"**		
PHRIB	**37176**	**Iris Diaphragm,** 80mm maximum opening, with large screening disc; mounted to **rider "7"**		
PYLJL	**37178**	**Total Accessories B:**		
		Note: *If desired, we can supply, in place of No. 37172:*		
PHLOS	**37180**	**Polarizer,** 42x14mm, of increased light transmitting power (**Price to be added to No. 37172**)		
		C: Accessories for surface projection in polarized light:		
		C-1: For Orthoscopic (Mineral Structure) **Projection:**		
PHIRS	**37182**	**Iris Diaphragm,** on slider		
PHOKI	**37184**	**Projection Objective,** 64mm, **with rotatable analyzer;** mounted to **rider "5"**		
		C-2: For Conoscopic (Interference Figure) **Projection:**		
PHEIT	**37186**	**Rider "6",** with slider fitting for the accommodation of condensers Nos. 37188-37190		
PHOND	**37188**	**Condenser,** with special front lens, on slider		
PHENS	**37190**	**Two-Lens Condenser,** in centering mount, on slider		
PYLTW	**37192**	**Total Accessories C:**		
		Note: *If desired, we can supply in place of No. 37184:*		
PHOBE	**37194**	**Projection Objective,** 80mm, **with rotatable analyzer,** (**Price to be added to No. 37184**)		
		D: Micro-projection in polarized light:		
PHTUB	**37196**	**Microscope Tube,** with objective changer and analyzer on joint		
PHAXA	**37198**	**Auxiliary Lens,** for attachment to the microscope tube, serving the projection of interference figures		
PETTA	**22002a**	**Achromatic Objective, 3.2X** (40mm), free from polarization		
PETME	**22006b**	**Achromatic Objective, 6X** (24mm), free from polarization		
PETNO	**22010a**	**Achromatic Objective, 14X** (13mm), free from polarization		
		Forward:		

(*Continued on page 272*)

Projector "MPS"—(Continued)

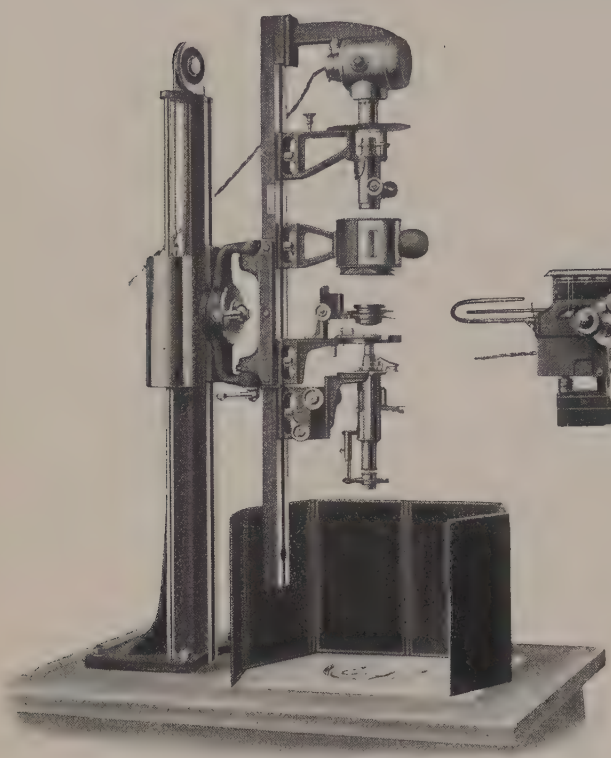
Code Word	Cat. No.	Designation	Price Unit	Price Total
		Forwarded:	$	$
APONN	37200	**Apochromatic Objective, 46X** (4mm), special objective for projection		
PYLUC	37202	**Four Objective Centering Adapters** (one for each objective listed above)		
PHIBB	37204	**Large Spectacle Condenser,** on slider (for objective 3.2X and "Micro-Summars")		
PHINU	37206	**Small Spectacle Condenser,** on slider (for objectives 6X and 14X)		
MOGIS	37208	**One each Selenite and Mica Plate,** on slider		
PYLVD	37210	**Total Accessories D:**		
		Note: *If the equipment under "C" is not ordered, one item listed under that heading is required for the equipment outlined under "D", viz:*		
PHEIT	37186	**Rider "6",** with slider fitting for the accommodation of condensers Nos. 37204-37206		
		E: Valuable Accessories for use in the various investigation methods listed under "B", "C" and "D":		
KISAL	37212	**Collection of 33 Preparations,** for the demonstration of all important phenomena in the field of crystal optics (*described in booklet Pol. No. 2039, see page 270*)		
PHSYN	37214	**Arrangement for Synchronic Rotation of the Nicols,** (attachable to polarizers Nos. 37172 and 37180 as well as analyzers Nos. 37184 and 37194)		
PHITT	37216	**Vertical Table Plate,** with rider, for the accommodation of objects used in experiments		
		F: Accessories for the demonstration of physical phenomena:		
PHOST	37218	**Light Exclusion Adapter,** on rider		
PHOLZ	37220	**Centering Bolt,** on rider, serves to align the individual accessories to the optical center		
PHTIG	37222	**Horizontal Stage Plate,** surface 100x100mm, on rider		
PHERY	37224	**Vertical, Rotatable Object Stage,** with centering device, on rider		
PHTEM	37226	**Three Holders,** oriented in one line for the accommodation of filters, on rider		
PHTOX	37228	**Three Holders,** oriented one after another for the accommodation of filters, on rider		
PHTAN	37230	**Ground Glass Screen,** 180x180mm, in frame, on rider		
PHRIB	37232	**Large Iris Diaphragm,** 80mm maximum opening, with large screening disc, on rider		
PHTYL	37234	**Regulation Iris Diaphragm** (maximum opening 30mm), with screening disc, on rider		
PHRAP	37236	**Slit,** adjustable in two directions vertically to each other, on rider		
PHYKO	37238	**Plano-Convex Lens,** 50mm diameter, 100mm focal length, on rider		
		(*Other lenses of different diameter and focal length can be supplied. Prices upon request.*)		
PHYPE	37240	**Screening Disc,** with arrow stamped thereon, 30mm high, on rider		
PHYZU	37242	**Centering Mount,** for clamping thereto mounted or unmounted lenses, on rider		
		(*Prices of individual lenses or objectives will be supplied upon request.*)		
PHYLY	37244	**Set of Glass Plates,** rotatable and inclinable, for the demonstration of polarization by reflection and diffraction on rider—for these experiments two riders each with a set of glass plates are required **each, $**		
PHRET	37246	**Three-Sectional Dispersion Prism,** straight vision		
PHRON	37248	**Prism of Crown Glass** 60°, edge **30**mm long		
PHRUM	37250	**Prism of Flint Glass** 60°, edge **130**mm long		
PHYGI	37252	**Diffraction Grating,** photographed, 1,000 lines to 10mm		
		(*Diffraction gratings of other values can be furnished if desired. Prices upon request.*)		
PYLWF	37254	**Total Accessories F:**		

Projector "MPS"—(Continued)

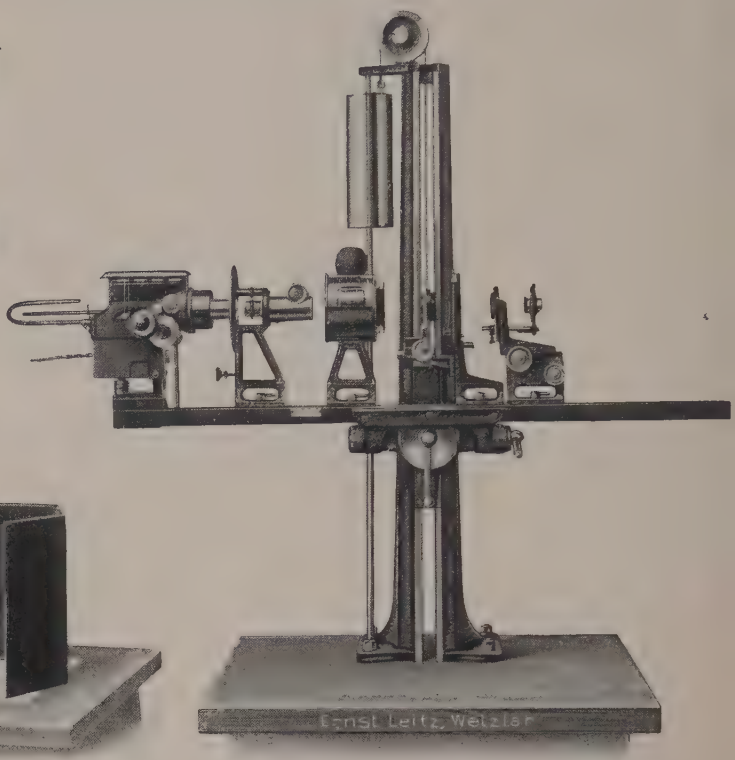
Code Word	Cat. No.	Designation	Price Unit	Price Total
		Note: *For physical and similar experiments, we supply a standard selection of riders which we believe are most currently used. Special devices for definite experiments are not offered by us on account of these experiments being greatly diversified and are better made to order by the institution itself. We wish to emphasize, therefore, that the accessories listed under "F" simply represent a suggestion of a suitable selection. We are only too glad to make to order devices such as will actually suit within the frame of our manufacture.*	$	$
		G: Accessories for the projection of spectral analysis:		
PHUCK	**37256**	**Small Optical Bench,** screening disc attached thereto, with adjustable double slit; achromatic lens focusable by rack and pinion; three-sectional glass prism in metal mounting; on rider		
		As suitable filters, we recommend:		
IFBLA	**32822**	**"Lifa" Filter, blue,** Grade No. 201a		
IFGRU	**32824**	**"Lifa" Filter, green,** Grade No. 201b		
IFROT	**32826**	**"Lifa" Filter, red,** Grade No. 201c		
		The following photo objectives, anastigmatic, 1:4.5 wide angle type, with iris diaphragm, will prove very desirable for projection in connection with the methods described in the foregoing:		
SUMAN	**28238**	**"Micro-Summar" 24**mm		
SUMEX	**28240**	**"Micro-Summar" 35**mm		
SUMIT	**28245**	**"Micro-Summar" 42**mm		
SUMOS	**28247**	**"Summar" 64**mm		
SUMUR	**28250**	**"Summar" 80**mm		
SUMMY	**28252**	**"Summar" 100**mm		
SUMZO	**28255**	**"Summar" 120**mm		
		Accessories required for the arclamp listed with the equipment under "A":		
RACTU	**32665**	**Rheostat, 110**-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**)		
RACUP	**32670**	**Rheostat, 220**-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**)		
RACVR	**32675**	**Carbon,** 250x5mm (horizontal) for D.C. **per 10**		
RACWO	**32680**	**Carbon,** 120x6mm (vertical) for D.C. **per 10**		
RACYX	**32685**	**Carbon,** 250x4.5mm (horizontal) for A.C. **per 10**		
RACZY	**32690**	**Carbon,** 120x7mm (vertical) for A.C. **per 10**		

UNIVERSAL APPARATUS "EDP"

for the Projection and Demonstration of Optical Phenomena in Polarized Light



Apparatus "EDP"
Arranged for Vertical Projection and Drawing



Apparatus "EDP"
Arranged for Horizontal Projection

This instrument represents a most universal device for class room and personal use in the observation, projection, drawing and photography of optical phenomena under the influence of polarized light.

A: Micro-Projection—***(Orthoscopic and conoscopic micro-projection in polarized light is possible for all purposes of petrography, mineralogy, biology, and other fields of investigation.)***

The projection microscope is situated at the extreme end of the optical bench and is held in place by an eccentric lever. The tube is equipped with an objective clutch changer and for each objective a separate centering adapter is provided. The centering of the objective needs to be carried out only once with the aid of the provided watch keys, the objectives remaining permanently centered even when being interchanged. The tube is furthermore provided with a slit for the introduction of compensators. A *"Bertrand"* lens in sliding mount serves conoscopic (interference figure) projection and the lens being mounted to a slider having centering screws, permits careful centering, and focusing by displacing the lens vertically within the tube. An iris diaphragm is permanently attached to the *"Bertrand"* lens for stimulating a contrast within the interference figure.

The microscope tube has two notches at an angle of 45° for the accommodation of oculars with crosslines. The analyzer attaches to a rod at the side of the tube permitting the analyzer to slide closely to the ocular. The analyzer can be rotated; if not desired it may be readily swung aside.

Illumination is furnished by two condensers which screw into the centering mount and together with the latter slip into the condenser carrier. The use for which the condensers are primarily intended is inscribed on their mount. The preparation is placed on the object stage with the coverglass

(Continued on page 275)

Universal Apparatus "EDP"—(Continued)

facing the objective. The correct illumination is easily and systematically found by setting the rack and pinion motion of the collimator lens unit so that the back surface of the condenser is completely filled with light and if necessary, the lamp is to be centered. In focusing the microscope without analyzer and setting the condenser with the aid of the rack and pinion, maximum brilliancy of illumination is attainable. Likewise, it is to be observed that the collimator lens unit by means of its rack and pinion be arranged in such a position that the illumination becomes uniform. We supply the apparatus with either the new model automatic-feed arclamp 5-8 ampere, or with an incandescent low-voltage lamp 6-volt, 5-ampere. For horizontal projection on a screen, the arclamp should be given preference while either of the two lamps is adaptable for vertical projection upon the table surface and drawing specimens.

The table which follows renders information in respect to the compound magnifying power of objectives and oculars at a distance of 250mm vision and likewise indicates which condenser units are to be preferred for the particular objective used. (It has to be borne in mind that the magnifications given increase or reduce in proportion to the distance of the ocular from the screen or table surface respectively.)

Objective	N. A.	Magnification with ocular 5X	6X	Condenser to be used
3.2X (40mm)	0.12	16	19	Spectacle Lens Condenser
6 X (24mm)	0.20	30	36	
10 X (16mm)	0.25	50	60	Lower portion of the two-lens condenser
14 X (13mm)	0.40	70	84	
20 X (9mm)	0.45	100	120	
30 X (6mm)	0.65	150	180	Complete two-lens condenser
45 X (4mm)	0.85	225	270	
62 X (3mm)	0.85	310	375	
100 X (1.8mm)	1.30	500	600	

A-1: Orthoscopic Micro-Projection—The complete microscope arrangement is utilized for the projection of structural details in microscope specimens but it is necessary that the auxiliary *"Bertrand"* lens is swung from the optical rays. The objectives have to be selected for their power to meet the arising requirements; i.e., to be suited in their magnification as the structural details call for. For orthoscopic projection, the objectives exceeding medium power are very seldom employed.

A-2: Conoscopic Projection—Objectives from 20X upwards, according to the aperture required, the complete two-lens condenser, the *"Bertrand"* auxiliary lens and an ocular are utilized for this mode of projection. The interference figure is focused by shifting the *"Bertrand"* auxiliary lens along the microscope axis.

When the interference figure of a small mineral grain contained within a rock section is to be viewed, the iris diaphragm of the *"Bertrand"* lens must be closed sufficiently and the specimen so oriented that the image of the grain appears within the plane of the diaphragm. The extent of stopping down the image may easily be controlled with the aid of a magnifier used beneath the analyzer, the latter being swung aside while this is being done.

B: Projection of General Features and of Physical Phenomena.

Objects up to 24mm in diameter may be exposed to general view especially for demonstrating the presence of double refraction and polarization in calcite-rhombs, complementary interference, dependence of the interference colors upon thickness, intensity of the double refraction and orientation of the section, scale of interference colors, spectrum analysis of interference colors, optical rotation, dichroism, accidental double refraction, interference figures, dispersion of the optical axis, dependence of the angle of the optical axis upon temperature, etc.

Note: *Directions for carrying out these demonstrations will be found in the booklet Pol. No. 2039. This booklet furthermore lists a suitable set of preparations for the demonstration of all important phenomena in the field of crystal optics and contains the requisite descriptive text.*

(Continued on page 276)

Universal Apparatus "EDP"—(Continued)

B-1: In Parallel Light—The projection objectives 64mm or 80mm are by means of their adapters attached to the projection unit. The analyzer is fitted to the tubular mounting and moved as close to the objective as is possible. Those condensers marked to correspond with the objectives utilized are placed into the condenser carrier. The latter has a revolving ring for the interposition of compensators.

A small spectroscope may be made to serve the demonstration of spectral analysis of interference colors. This spectroscope attaches beneath the analyzer in such manner that it may be easily placed in and out of operation. It is provided with an adjustable slit as well as a movable lens for focusing the spectrum.

For demonstrating the fundamental laws of double refraction and polarization produced by calcite-rhombs, the condenser should be placed in its carrier utilizing the appointed iris diaphragm. The latter has a rotating mount for the reception of a quartz plate cut at right angles to the optical axis, being 3.75mm thick (for color mixing experiments), or of a selenite plate.

B-2: In Convergent Light *(Interference Figure Demonstration)*—The two-lens condenser is placed into the condenser carrier, while underneath the stage is introduced a corresponding condenser which with the guide pin provided for this purpose is moved upward as far as possible. In other respects the arrangement is the same as that adopted for parallel light. With the aid of the projection objective, the image is focused upon the back surface of the lower condenser. The analyzer is moved away from the projection lens to that point where the pencil of rays has its smallest cross section. The illumination is then regulated by adjusting the position of the upper condenser. In this manner it will be possible to likewise demonstrate interference figures in very thick preparations.

C: Photography (***Photo-Micrography and Recording General Features***):

Photographs may be taken with the aid of a special camera provided with an automatic time and instantaneous shutter. This camera attaches by means of clamps to the vertical column of the apparatus. A light-proof connection between the projection lens and the camera is made with the aid of a plate carrying two auxiliary lenses of 250 and 400mm focus, the plate attaching itself to the guide pin of the analyzer. The purpose of these auxiliary lenses is to obtain for photo-micrography a tele-centric exit of the rays from the projection lenses so as to first obviate astigmatic defects in the image due to the analyzer, and secondly to be able to employ the microscope objectives under the most favorable conditions in respect to their optical correction. In every case such an auxiliary lens should be put in operation, the focal length of which comes nearest to the distance which exists between analyzer and the photographic plate.

The image should be focused upon a paper focusing screen inserted into the frame in place of the ground glass focusing screen. The image is viewed for sharp focusing while regulating the illumination through the observation window situated on the lens board of the camera or by releasing the catch and lifting aside the bellows. The observation window is controlled by a wire spring release. Plateholders are available for plates of a size up to 5 x 7 in. and for plates of smaller sizes through the use of reducing kits. Light filters may be introduced into the holder situated at the cooling chamber.

D: Projection of Lantern Slides:

After all saddle stands with the exception of the source of light are removed from the optical bench, the large two-lens condenser with lantern slide frame is attached and mounted at its appointed index mark which records the accurate screen distance. Next is to be attached the saddle stand with carrier for the projection objective and into this carrier is introduced the same slide fitting as is used for the projection of general features, the screw thread of which will receive the lantern slide projection lens representing an anastigmatically corrected objective of 120mm focal length. When lantern slides are projected by means of the incandescent low-voltage lamp, an auxiliary lens is to be inserted into the mounting at the lamp housing.

Note: *Due to lack of space, the apparatus "EDP" has been described rather briefly, but to those interested, we shall be glad to send special pamphlet Pol. No. 2263 which contains an elaborate account of the instrument and a series of illustrations conveying its adaptability and universal mode of application.*

(*Continued on page 277*)

Universal Apparatus "EDP"—(Continued)

Code Word	Cat. No.	Designation	Price Unit	Price Total
		A: Essential Parts of Model "EDP" required for all modes of projection:		
EDPOL	**37270**	**Wooden Table with Drawer,** mounted thereto vertical column, the latter supplied with optical bench adjustable in height, provided with two turn sockets and counter-poised weight	$	$
EDPUT	**37272***	**New automatic-feed arclamp,** 5-8 ampere, with clockwork mechanism, with rider for attachment to optical bench		
		Note: *Dependent upon the current conditions, either of the rheostats listed below is required for use with No. 37272:*		
RACTU	**32665**	**Rheostat, 110**-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**)		
RACUP	**32670**	**Rheostat, 220**-volt (renders lamp available at 5-6 amperes on **D.C.** and at 8 amperes on **A.C.**)		
RACVR	**32675**	**Carbon,** 250x5mm (horizontal) for **D.C.** **per 10**		
RACWO	**32680**	**Carbon,** 120x6mm (vertical) for **D.C.** **per 10**		
RACYX	**32685**	**Carbon,** 250x4.5mm (horizontal) for **A.C.** **per 10**		
RACZY	**32690**	**Carbon,** 120x7mm (vertical) for **A.C.** **per 10**		
		As alternate source of light, we offer:		
EDANI	**37274***	**Incandescent Low-Voltage Lamp,** 6-volt, 5-ampere, in housing, with rider for attachment to optical bench		
		Note: *Dependent upon the current conditions, either a rheostat or transformer is required for use with No. 37274, selection of which can be made from the following:*		
REDIG	**32855**	**Rheostat,** stationary, for lamp on **110**-volt **D.C.**		
REDUK	**32860**	**Rheostat,** stationary, for lamp on **220**-volt **D.C.**		
BYSFI	**32865**	**Transformer,** stationary, for lamp on **110**-volt **A.C.**		
BYSGO	**32870**	**Transformer,** stationary, for lamp on **220**-volt **A.C.**		
LINID	**32875**	**Lamp Bulb,** 6-volt, 5-ampere		
EDHAN	**37276**	**Light-Screening Curtain,** for vertical projection on table when apparatus is used for drawing purposes		
		B: Accessories for Micro-Projection in Polarized Light:		
EDLOK	**37278**	**Saddle Stand,** with lamp-condenser, polarizer and collimator illuminating lens attached thereto		
EDKUL	**37280**	**Saddle Stand,** with cooling chamber and filter holder attached thereto		
EDSCH	**37282**	**Saddle Stand,** attached thereto rotatable object stage graduated at its periphery with vernier reading to 0.1°, removable ring plate, detachable condenser carrier with rack and pinion motion, object support and two stage clips		
EDZEN	**37284**	**Centering Mount,** for condensers		
EDBRI	**37286**	**Spectacle Lens Condenser,** for use with objectives **3.2X** (40mm) and **6X** (24mm)		
EDSER	**37288**	**Two-Lens Condenser,** N.A. 1.20, with demountable front lens and iris diaphragm attached		
EDUTE	**37290**	**Saddle Stand,** attached thereto tube carrier with coarse adjustment by rack and pinion and micrometer screw of patented ball-bearing type		
EDUBS	**37292**	**Dove-Tailed Slider,** attached thereto microscope tube with objective clutch changer, tube provided with slit at 45° for insertion of compensators, "*Bertrand*" auxiliary lens in centering and focusing mount, with iris diaphragm		
EDLYS	**37294**	**Analyzer,** revolving, graduated and notched, with detachable and swing-out holder		
EDLUP	**37296**	**Holder,** with auxiliary magnifier		
EDOPT	**37298**	**Set of Objectives,** free from polarization: **3.2X** (40mm), **6X** (24mm), **20X** (9mm) and **45X** (4mm), each objective provided with separate centering adapter		
EDOKU	**37300**	"*Huyghenian*" **Ocular, 5X,** with crosslines and adjustable eyelens		
EDUKA	**37302**	"*Huyghenian*" **Ocular, 6X**		
EDYPS	**37304**	**Selenite Plate,** red, 1. order in mounting fitting the tube slit		
EDGLI	**37306**	**Mica Plate,** 1/4λ, in mounting fitting the tube slit		
EDIRM	**37308**	**Folding Cardboard Light Screen**		
EIBTH	**37310**	**Total Accessories B:**		
		Note: *Additional objectives and oculars can be supplied for this set, if required. When ordering, please state expressly that objectives free from polarization are to be supplied and also order for each objective a centering collar. Oculars with crosslines should in all cases be ordered with focusable eyelenses.*		

*Both lamps are interchangeable with each other.

(*Continued on page 278*)

Universal Apparatus "EDP"—(Continued)

Code Word	Cat. No.	Designation	Price Unit	Price Total
		C: Accessories for the Projection of General Features and Physical Phenomena:	$	$
EDSIT	37312	**Slider,** for low power objectives, with sleeve for the insertion of the analyzer		
EDSUM	37314	**Set of Objectives,** consisting of one each "Summar" 64 and 80mm		
EDSPE	37316	**Spectroscope,** with holder and focusable projection lens		
EDSYN	37318	**Condenser,** for objectives 64 and 80mm, with rotatable ring for the reception of compensators		
EDGIP	37320	**Selenite Plate,** red, 1. order, 29mm diameter, in mounting		
EDLIM	37322	**Mica Plate,** 1/4 λ, 29mm diameter, in mounting		
EDYSE	37324	**Sliding Sleeve,** for insertion into condenser carrier, with small iris diaphragm and rotatable ring for quartz or selenite plates		
EDSAL	37326	**Two-Lens Condenser,** N.A. 1.20, with ground-off front lens and holder for attaching under the object stage		
EDPHY	37328	**Total Accessories C:**		
		Note: To avoid misunderstanding it should be borne in mind that for use of accessories listed under "C", the items Nos. 37278, 37280, 37282, 37284, 37288, 37290, 37294 and 37308, as listed under "B" are likewise required.		
		D: Accessories for Photo-Micrography:		
EDKAM	37330	**Camera,** with 600mm bellows extension; lens board, with rack and pinion motion; time and instantaneous shutter; light-proof connecting sleeve; observation window at the side of the lens board; paper focusing screen in wooden frame; two plateholders for plates 5x7 in., with reducing kits for smaller sizes down to 3¼x4¼ in		
EDKIB	37332	**Light-Proof Connecting Sleeve,** with two diopter auxiliary lenses of 250 and 400mm focal length		
EDFOT	37334	**Total Accessories D:**		
		E: Accessories for Lantern Slide Projection:		
EDDON	37336	**Carrier,** with double condenser and two lantern slide frames.		
EDDAS	37338	**Anastigmatic Projection Lens,** 120mm		
EDJEK	37340	**Slide Fitting,** to which the projection lens is to be screwed		
EIBUB	37342	**Total Accessories E:**		
		Note: *For the projection of lantern slides with the incandescent low-voltage lamp, it will be necessary to likewise order:*		
EDHIL	37344	**Auxiliary Lens,** for insertion into the housing of the low-voltage lamp		
KISAL	37212	**Collection of 33 Preparations,** for the demonstration of all important phenomena in the field of crystal optics (*described in booklet Pol. No. 2039, see page 270*)		

PROJECTION SCREENS WITH OPAQUE SURFACE

We offer plain and aluminum coated opaque screens of selected quality having a high degree of opacity and a perfect reflecting surface. For ordinary work under normal conditions when rooms can be darkened sufficiently, we recommend plain white screens. In instances where utmost brilliancy in projection is required, the aluminum coated screen is preferred; however, this screen does not permit a clear view from as great an oblique angle as does the white opaque screen.

Both screens are supplied on spring rollers with accessories for hanging same.

Code Word	Cat. No.	Designation	Price
		1) Plain-Coated Screens:	$
HAPAM	**26200**	**Screen,** white, plain-coated, **6x6 ft.**	
HAPCX	**26205**	**Screen,** white, plain-coated, **7x7 ft.**	
HAPBF	**26212**	**Screen,** white, plain-coated, **8½x8½ ft.**	
HAPFY	**26220**	**Screen,** white, plain-coated, **10x10 ft.**	
HAPGH	**26225**	**Screen,** white, plain-coated, **12x12 ft.**	
		2) Aluminum-Coated Screens:	
HAPIC	**26230**	**Screen,** aluminum-coated, **6x6 ft.**	
HAPJZ	**26235**	**Screen,** aluminum-coated, **7x7 ft.**	
HAPHQ	**26242**	**Screen,** aluminum-coated, **8½x8½ ft.**	
HAPME	**26250**	**Screen,** aluminum-coated, **10x10 ft.**	
HAPNT	**26255**	**Screen,** aluminum-coated, **12x12 ft.**	

Opaque Screens of Special Type—We supply two screens with beaded surface representing the latest development towards increasing the reflection. In their manufacture, thousands of tiny glass beads free from color are imbedded in a water-proof binder producing a washable surface which gives a maximum of reflected light and an undistorted image. The brilliancy of the picture so produced makes it possible to view the image from a greater distance than is possible with other types of screens.

This beaded screen is furnished in two models one mounted within a wooden frame having foldable legs by which the screen may be supported on any available table or other suitable piece of furniture. The other model is of foldable pattern and collapses within a carrying case.

Code Word	Cat. No.	Designation	Price
ELRXD	**25603**	**Beaded Screen,** 26x35 in., **in wooden frame,** with folding legs and metal carrying handle, weight 8½ lbs.	$
ELRLX	**25606**	**Beaded Screen, foldable pattern,** with projection surface 27x36 in., in dust-proof mahogany finish case with carrying handle, size of case 40x4x4½ in., weight 10¼ lbs.	

Note: The screens Nos. 25603 and 25606 are especially recommended for use with the "Uleja" film slide projector No. 25600, listed on page 257.

Screens for Projection in Daylight—For this purpose, screens of translucent fabric are to be utilized and the projection apparatus is placed in sufficiently close approximation to the screen (the screen being situated between audience and projector). These screens permit to project pictures in broad daylight. Care has to be exercised, however, that no direct rays from a powerful electric lamp or sunlight fall on the screen or objective since this would impair satisfactory results. In addition, it has to be considered that a smaller picture is obtained to offset the illumination of the room.

Code Word	Cat. No.	Designation	Price
HAPOR	**26300**	**Translucent Screen,** size **24x30 in.,** with frame and stand	$
HAPRO	**26310**	**Translucent Screen,** size **30x36 in.,** with frame and stand	
HAPTN	**26320**	**Translucent Screen,** size **36x45 in.,** with frame and stand	
HAPVU	**26330**	**Translucent Screen,** size **50x60 in.,** with frame and stand	

Note: 1) The above translucent screens can likewise be supplied in fiber case; price upon application.
2) Translucent screens of larger size than listed will be quoted upon request.

LEICA

The Universal Camera

The Smallest Camera with Focal Plane Shutter

The *"Leica"* camera is an exceedingly small but highly developed instrument. Although it is better adapted to ordinary camera use than the average, its unique design, precision construction and highly corrected optical system make it adaptable to a variety of uses.

The film utilized is the standard 35mm motion picture film, but by arranging the camera so that the picture is taken the long way of the film, a negative is produced approximately 1 x 1½ in. or twice the size of a standard cinema frame. Five and one-quarter feet of film are used for each loading and this permits of 36 exposures.

The camera is supplied with the Leitz anastigmat *"Elmar"* F:3.5 of 50mm focus. This lens is exceptionally well corrected for both chromatic and spherical aberration which together with an extreme flatness of field make it what an eminent photographic authority has called **"the best corrected anastigmat ever placed on a photographic camera."**

Due to its compactness and its light weight, the "Leica" is ideal for travelling under all conditions as it may be carried in any pocket, even the vest pocket. Add to this, the extremely fine photographic quality of the lens equipment and we find the reason for its extraordinary popularity and success for use in portraiture, landscape, sports, copying and photo-micrography.

The shutter with which this camera is equipped is of the self-capping focal plane type. It permits of instantaneous exposures of from 1/20th to 1/500th of a second. It should here be noted that 1/500th of a second used to cover so small an area and in conjunction with a lens of only 2 in. focus is equivalent to approximately 1/1500th of a second on a larger camera equipped with a 6 in. lens. It will readily be seen that this, therefore, is sufficient to stop practically any sort of motion which is visible to the eye. It is equally possible by means of a specially designed wire release to operate this shutter for very long time exposures. No focal plane shutter has been produced having so few moving parts and therefore it has less tendency to cause mechanical difficulties. **The reliability of this shutter under extreme climatic conditions was well demonstrated in its use with the Greenland Expedition of the University of Michigan. At that time, it proved to be the most dependable equipment possessed by the expedition and frequently permitted photographs which otherwise would have been impossible to obtain.**

The negatives produced by the *"Leica"* are extremely sharp and of fine definition. They therefore may be enlarged to enormous size or transferred to positive film and projected on a screen, in which case the results are fully the equal of the best glass lantern slides without possessing the latter's objectionable features of size, weight and breakableness.

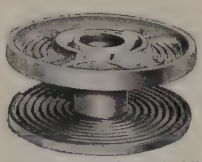
Code Word	Cat. No.	Designation	Price
LESSA	**35010**	**"Leica" Roll Film Camera** with **focal plane shutter,** including three magazines, range finder and cowhide case.....	$
FILBY	**35150**	**Yellow Filter I, light,** in mounting for "Leica" camera with focal plane shutter (increases exposure about twice).....	
FILGE	**35155**	**Yellow Filter II, medium,** in mounting for "Leica" camera with focal plane shutter (increases exposure about four times).....	
FILTU	**35160**	**Yellow Filter III, dark,** in mounting for "Leica" camera with focal plane shutter (increases exposure about six times).....	
FISON	**35185**	**Sun Shade,** attaches to "Leica" camera with focal plane shutter.....	
FILMO	**35100**	**3 Strips Cinema Negative Film "Agfa" (non-orthochromatic,** sensibility—16/17° SCH.) each 5¼ ft. long—(for 3x36=108 exposures), **standard packing,** in one light-proof tin.....**per tin**	
FIRUZ	**35110**	**3 Strips Cinema Negative Film "Perutz" (orthochromatic,** sensibility—16/17° SCH.) each 5¼ ft. long (for 3x36=108 exposures) **standard packing,** in one light-proof tin.....**per tin**	

Note: The complete "Leica" line, including accessories, is listed in pamphlet No. 1127 which we forward upon request.

"Reelo" Tank

— A simple, compact and convenient tank for developing strips of standard cinema film not more than six feet in length —

No. 35315



Reel of No. 35315

The *"Reelo"* tank has been especially designed for the convenient handling of *"Leica"* films but is also adaptable to any 35mm motion picture film which is not more than 6 ft. in length. The tank consists primarily of a "Bakelite" reel, the inside of which is cut with spiral groves and the flanges so spaced that the distance between them is slightly less than the width of the film. By simply bending the film a little between the fingers, the end is inserted in a clip on a spindle and the reel rotated in a direction opposite to the hand holding the film, when the film itself will travel through the spiral grooves. This method is so simple and easy that it can readily be done in a changing bag or in a dark closet and because of the small size of the tank, it is a practical and convenient form of equipment for the traveler as well as one who works at home or in the laboratory. Once the reel is loaded and placed in the tank with the cover in position, the balance of the operation may be completed in daylight.

The tank itself is of a light-weight metal, plated with a chemical-resisting composition and is provided with an overflow tube whereby developer, water and fixing bath may be emptied without removing the cover. The cover is of the same material as the tank itself and is fitted with a tube in the center which projects down into the middle of the reel. This permits of the filling of the tank with liquids and at the same time excludes the light from the film.

By means of the "Reelo" tank, one may develop his negatives in the field almost as soon as they have been taken. This is always a distinct advantage because a photographic emulsion deteriorates far more rapidly after exposure than before. It is of particular advantage when travelling in climates where heat and moisture are present in sufficient a manner to harm the film if left in its undeveloped state.

Code Word	Cat. No.	Designation	Price
FETAN	**35315**	**"Reelo" Developing Tank, Size 1,** for "Leica" and other standard motion picture film up to 6 ft. in length, for use with **one** film reel only including **one** reel	$

"Eldia" Printer

— For the printing of 35mm Cinema Film Negatives either single or double frame —

This is undoubtedly the most compact and yet efficient printing apparatus for motion picture film ever produced. The *"Eldia"* printer is but slightly larger than the *"Leica"* camera and weighs about the same. It can therefore be carried in the pocket if desired. By this construction, a roll of positive film or of bromide paper may be placed in the instrument and as soon as an exposure is made, the film or paper is turned by means of the knurled knob at the top of the "take-up" spool and in turning passes over a sprocket wheel which engages the perforations of the film or paper. This sprocket wheel is fitted with a ratchet producing a distinct click as soon as the film or paper has been turned the distance of one single frame. Therefore, when printing *"Leica"* negatives, the film or paper is turned until the second click is heard when an entirely free area will be exposed to the next *"Leica"* negative.

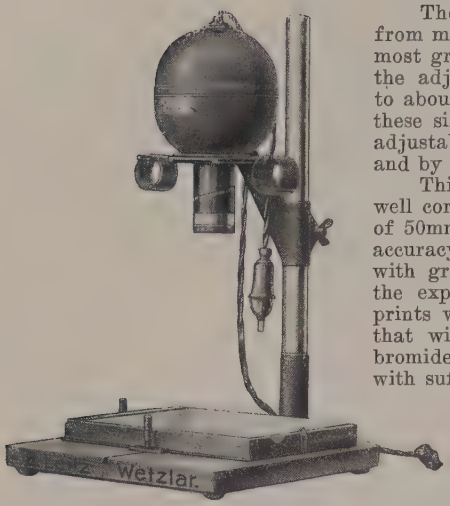
The film window of the printer is easily and quickly removable and is obtainable in either the single frame size or the *"Leica"* frame size. The negative strip is held under this film window with the ends of the strip protruding beyond the printer. This permits of a shifting of the strip by any desired number of negatives so that while a continuous strip of positives is produced, the sequence of these positives is not dependent upon the sequence of the negatives but may be controlled at the will of the operator.

Code Word	Cat. No.	Designation	Price
ELDIA	**35550**	**Printing Apparatus,** for printing "Leica" negatives 1⅜x1 in. on positive film and "Bromaryt-Bromide" paper	$
ELKIN	**35555**	**Reducing Mask,** for use of No. 35550 in connection with standard cinema negatives of size ¾x1 in.	
ELDOS	**35560**	**3 Strips Diapositive Film** "Agfa" each 5¼ ft. long (for 3x36=108 positives), standard packing in one light-proof tin **per tin**	
EBROM	**35565**	**1 Roll "Bromaryt-Bromide" Paper,** 5¼ ft. long and 1⅜ in. wide	

Note: The complete "Leica" line, including accessories, is listed in pamphlet No. 1127 which we forward upon request.

Universal Enlarger

— The Ideal Enlarger for "Leica" and other 35mm Cinema Film Negatives —



The universal enlarger is especially designed for producing from motion picture film negatives of any size, the sharpest and most grainless enlargements possible. This enlarger, which is of the adjustable type, permits of enlargements of from 2 x 3 in. to about 12 x 18 in. from *"Leica"* negatives and about one-half of these sizes from single frame motion picture film negatives. The adjustable paper support will handle paper up to 7 x 10 in. in size and by removing this, still larger sheets may be used on the board.

This enlarger is equipped with an F:3.5 anastigmatic lens as well corrected as that which is used in the *"Leica"* camera. It is of 50mm focus and therefore reproduces the picture with the same accuracy as the lens with which it was taken. An iris diaphragm with graduated scale is fitted to the lens, permitting control of the exposure; this has been found necessary where very small prints were desired as the efficiency of the apparatus is so great that with a normal *"Leica"* negative enlarged to 2 x 3 in. on bromide paper, it is practically impossible to operate the switch with sufficient rapidity. The addition of the diaphragm, however, permits of cutting down the light to any required amount.

The lamp housing is of all metal construction and very efficiently ventilated. The upper half which is removable contains the socket in which is fitted a *"Nitra"* opal lamp bulb of 60-watt. This source of light has proven itself to be the most efficient for this work. In the lower half of the lamp housing is mounted the condensing system which is of special construction, designed to emit parallel rays rather than divergent. This has a tendency to enlarge the picture without unduly magnifying mechanical defects in the negative and is also responsible to no small extent for the freedom from grain which enlargements so produced would otherwise show.

The negative strip is held in place in a special carrier consisting of two pieces of very thin plate glass, leather bound and hinged at one side. This carrier is held in position under two springs and thereby keeps the film perfectly flat. The ends of the pieces of glass are beveled and polished so that the film may be drawn through without danger of scratching.

The universal enlarger has rapidly proven itself to be superior to all other types and is now in use in some of the leading newspaper laboratories where reproductions are required from news reels.

Code Word	Cat. No.	Designation	Price
FILOY	**35480**	**Universal Enlarging Apparatus,** for variable magnification, with 60-watt "Nitra" opal lamp bulb, double glass plate for holding "Leica" film, bell switch with cord and plug, Leitz objective F:3.5 of 50mm focus with iris diaphragm, adjustable paper support with glass plate on hinge to hold the paper flat (**enlargements up to 8x10 in. and more**)....	$
FILIF	**35490**	**"Nitra" Opal Lamp Bulb,** 60-watt, for No. 35480, extra.....	
FLARA	**35495**	**Orange Filter,** in mounting to be clamped to the objective of apparatus No. 35480 and easily swung aside; to serve dampening the light for adjusting the enlarging paper in the darkroom without exposing the paper	

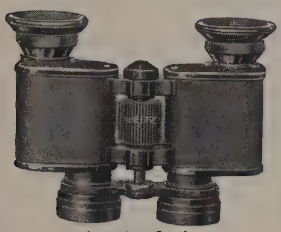
Note: The complete "Leica" line, including accessories, is listed in pamphlet No. 1127 which we forward upon request.

Projection

"Leica" negatives, due to their high quality, produce the most perfect type of positives for screen projection. Not only are they of extreme sharpness and definition but have the advantage over standard motion picture negatives in that they are twice as large and therefore require but half as much magnification to produce an image of equal size on the screen. This makes it possible and practical to avoid the expense and defects experienced in the use of glass lantern slides which are of infinitely greater bulk and weight and which are always subject to breakage. It is possible to carry a roll of three dozen *"Leica"* film slides in one's vest pocket without realizing that it is there, but three dozen glass lantern slides occupy a very considerable space, weigh several pounds and cost thirty to forty times as much to make. In addition to this, it should be remembered that the *"Leica"* camera can be used to take pictures either vertically or horizontally. Vertical pictures, when placed on a lantern slide, must be reduced in size and masked down to the short side of the plate whereas such *"Leica"* negatives reproduced on film may be thrown on the screen in their original form by means of the revolving front on the "Uleja" projector. For complete information on this equipment, refer to page 257.

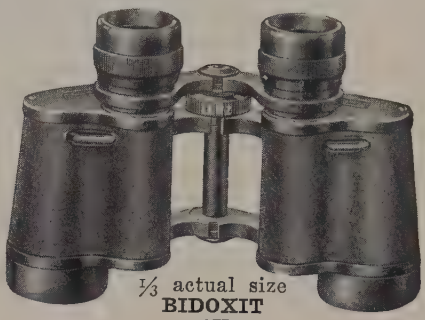
PRISM BINOCULAR FIELD GLASSES

The Leitz binocular field glasses are constructed **with the very same precision in optical and mechanical workmanship so readily identified with Leitz microscopes and other Leitz apparatus.** For the reason that we received from the scientific profession, many requests for literature on prismatic binocular field glasses and these inquiries indicate to us the extensive demand existing for these glasses amongst scientists for nature, bird and other studies, it suggested itself to us that we list in this catalog an assortment of the most popular models.



⅓ actual size
BIDAL
6X

⅓ actual size
BINOLIT
6X



⅓ actual size
BIDOXIT
6X

⅓ actual size
BIOCTIT
8X

⅓ actual size
BINUXIT
8X

⅓ actual size
FORSTA
8X

BIDAL, 6X, 15mm objective diameter—Represents a field glass of miniature size well adapted for excursion work when the binocular is expected to be used under fairly good light conditions only and special value being attached to have available a glass to be easily carried in the pocket.

BINOLIT, 6X, 24mm objective diameter—Is well suited for excursion work and satisfies all requirements in respect to light-transmitting power as well as field of view; it combines moderate size with light weight.

BIDOXIT, 6X, 30mm objective diameter—Is characteristic by its remarkable light-transmitting power and large field of view; this binocular is used with success in advanced dusk and hazy atmosphere, a feature very important if excursion work is attempted under diversified climatic conditions.

BIOCTIT, 8X, 24mm objective diameter—Serves such purposes for which a demand exists for a somewhat higher magnification than is considered adequate for general use; due to the higher magnification, the field of view and the light-transmitting power are naturally somewhat reduced compared to *"BINOLIT"* while the light and field are, however, sufficient particularly for use in daylight for which *"BIOCTIT"* is chiefly recommended. This glass is very desirable for nature and bird studies.

BINUXIT, 8X, 30mm objective diameter—Is endowed with an exceptionally large field of view in addition to a high light-transmitting power. Its qualifications render it the favorite glass for excursions, nature and bird studies.

FORSTA, 8X, 42mm objective diameter—Represents a special model of a high degree of light-transmitting power; the fact that even though of higher magnification than *"BIDOXIT,"* it exceeds the latter in light capacity is proof of its eminent advantages when used in advanced dusk and during night; *"FORSTA"* is equally well suited as night glass.

Code Word	Magnification	Free Diameter of Objectives mm	Exit Pupil mm	Light Transmitting Power	Linear Field of View in yds. at a Distance of 1,000 yds.	Weight Exclusive of Case ozs.	Price
BIDAL	**6X**	**15**	2.5	6.25	120	8	$
BINOLIT	**6X**	**24**	4	16	150	15	
BIDOXIT	**6X**	**30**	5	25	150	19	
BIOCTIT	**8X**	**24**	3	9	110	15	
BINUXIT	**8X**	**30**	3.5	14	150	21	
FORSTA	**8X**	**42**	5.25	27.6	110	28	

Note: 1) Each binocular is supplied in strong case of genuine cowhide with strap for case and shoulder strap for the binocular.

2) The complete line of prism binocular field glasses is listed in pamphlet No. 1134 which we forward upon request.

RANGE FINDERS

We supply two different models of range finders, one with base 40cm permitting measurements up to 1,000 meters and distances exceeding this to be estimated; and another type with base 20cm for measurements up to 500 meters and distances exceeding this value to be estimated. These instruments are well adapted for such purposes as laying out cable lines, measuring trees, work in railroad construction, agricultural lay-outs, hunting, geological surveys, height measurements of all kinds, cinematographic tele-photography, provisional surveys, at excursions and expeditions; their value is particularly appreciated when measuring the width and depth of inaccessible plots of land.

The range finder with 40cm base has been **used with great success by Prof. L. M. Gould in his geological surveys while with the Greenland Expedition** of the University of Michigan. In one of his letters, Prof. Gould writes,

> "Time was short and the relief of the land so rugged that extensive surveying was entirely out of the question. Not even a pace scale could be used satisfactorily for estimating distances. Here I found the Leitz *"Fardi"* range finder of great value," etc.

From this statement can readily be learned the advantages our range finders afford for work of the nature with which Prof. Gould had to deal. **Prof. Gould, who at present is with the Byrd Antarctic Expedition in the capacity of the expedition's geologist, has again included the range finder "Fardi" in his equipment as one of the essential items needed in his anticipated survey work.**

Prof. Lester Reineke of the United States Forest Surveys wrote in the "Forest Worker" about his experiences with the *"Fardi"* range finder in applying it to mapping, cruising, measuring tree heights, etc. **The favorable results which he obtained are further proof as to how successfully the range finder can be utilized in forest service.**

The range finder is built on the principle of coincidence. Being equipped with a detachable *"Galilean"* telescope magnifying approximately 3X, the range of the instrument and its accuracy of reading is greatly enhanced. The range finder with a base of 40cm is always furnished with the telescope while the model with base of 20cm can be supplied with or without the telescope arrangement.

The range finder consists of a rectangular brass tube of 45cm length as far as the instrument with base of 40cm is concerned, and of a length of 25cm in the range finder of 20cm base. The housing contains at one end a glass cube with a diagonal septum which partially transmits and reflects the light. At the other end is situated a right angle prism. The optical combination produces a double image of the sighted object and the process of finding the range is carried out in rendering these two images coincident. This is accomplished by turning a knurled disc revolving the prism around its pivots. The knurled disc is graduated in terms of distances and readings are taken against a fixed index. The instrument is covered with leather, and is dustproof and water-tight. The reading scale of the range finder with 40cm base covers a range from 12-300 meters (13-330 yards) and has subdivisions for fractional readings. In addition, there are marks for 400, 500 and 1,000 meters (or the corresponding yard measurements) and at infinity. These notations, however, are not sufficiently accurate for actual measurements and are only provided for general guidance.

The range finder with 20cm base has a reading scale ranging from 4-100 meters (or 5-110 yards) with appropriate subdivisions; the other marks for 200, 300, 400 and 500 meters (or the corresponding yard measurements) and infinity show only approximate figures.

(*Continued on page 235*)

Range Finders—(Continued)

The limits of accuracy of the range finder with 40cm base are as follows:

Up to 50 meters (or yards respectively)	+ or — ½%
From 50-100 meters (or yards respectively)	+ or — 1%
From 100-200 meters (or yards respectively)	+ or — 2%
From 200-300 meters (or yards respectively)	+ or — 3%

The instrument should not be used for accurate measurements beyond the latter distance.

The range finder with 20cm base and telescope attached is a little less accurate if compared to the one of 40cm base. Up to 100 meters the percentage error is approximately double that given above. When the instrument is used without the telescope the accuracy diminishes still further.

The adjustment of the various parts of the instrument is liable to be disturbed by thermal and other influences. In order to correct the resulting errors, the scale is not permanently attached to the knurled disc but can be freely displaced after the release of a screw head by which it may be reclamped in the correct position.

Before using the instrument, it should be sharply set to the sight of the observer and it should be made certain that complete coincidence occurs at infinity or by way of an alternative, 20 meters should be ranged off and the reading be verified on the scale disc. Coincidence is established when the double image of the object, as seen in the field of view in the telescope, viz., the secondary image within the smaller bright circle coincides with the primary image. If no coincidence results when the scale is set to the measured distance or at infinity, the knurled screw head is to be released at the center of the scale disc, the scale displaced to the distance of the scale line in question (infinity or 20 meters in this case) and the scale disc firmly reclamped. The small auxiliary scale from 0 to + or — 10 and the corresponding index serve as guide in estimating the amount of the deviation. When rectified, the readings are to be verified by a few tests. The readjustment should be carried out with the utmost care as this determines the accuracy of the reading.

When taking the range, it is advisable to take the lean of several readings. In general, it is immaterial whether the instrument is used in a horizontal or vertical position. When taking the range by sighting the objects which have sharply defined lateral contours, such as lightning rods, telegraph poles, flagstaffs, etc., it is generally best to hold the range finder in horizontal position, while objects with sharp horizontal outlines such as roof lines, forest contours and river courses, should be ranged off with the instrument held vertically.

Code Word	Cat. No.	Designation	Price
FARDI	**37360**	**Range Finder** with **40cm base,** *"Galilean"* telescope, of approximate magnification 3X, **in canvas case** with carrying strap (*weight inclusive of case 2½ lbs.; exclusive of case 1½ lbs.*)	$
FARNO	**37362**	**Range Finder** with **20cm base,** *"Galilean"* telescope, of approximate magnification 3X, **in canvas case** with carrying strap (*weight inclusive of case 1⅞ lbs.; exclusive of case 1 lb.*)	
FARSE	**37364**	**Range Finder** with **20cm base, without** telescope, **in canvas case** with carrying strap (*weight inclusive of case 1¾ lbs.; exclusive of case 14 ozs.*)	

Main Works—Wetzlar (Germany)

Branch Works—Wetzlar (Germany)

Branch Works—Rastatt (Germany)

The Leitz Works maintain a number of Branch Offices and Agencies throughout the world and through these facilities, prompt and efficient service in connection with Leitz apparatus is always obtainable. The established Branch Offices and Agencies are:

United States—
E. Leitz, Inc., New York, N. Y.
E. Leitz, Inc., Washington, D. C.
E. Leitz, Inc., Chicago, Ill.
E. Leitz, Inc., San Francisco, Cal.
E. Leitz, Inc., Los Angeles, Cal.

Africa—
Taeuber & Corssen, Capetown
Australia—
W. Ramsay, Melbourne
Austria—
Adolf Schmidt, Vienna IX 4
Belgium—
A. Fisch, Brussels
Bulgaria—
Handelshaus "Zadruga," Sofia
Canada—
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D. B. Kagenaar Sr., Utrecht
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Hungary—
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W. Koch, Zurich
H. Struebin & Sohn, Basel
Turkey—
Evlia Zade Noureddin, Constantinople

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